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NOVEMBER 1948

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CORRECTIONS

MONTHLY WEATHER REVIEW, September 1948, vol. 76, p. 191:

Table 1: The heading for the first column should read $<-30°$ instead of $>-30°$.

Table 2: The heading for the last column should read "Percent with error $<11°$" instead of "Percent with error $>11°$".

MONTHLY WEATHER REVIEW, October 1948, vol. 76, "Solar Radiation Data for October 1948," p. 233:

In Table 2, for Madison, Wis., departure from normal for October 16–21, +57; for Riverside, Calif., departure for period October 8–14 should read −13; for Fairbanks, Alaska, value for October 24 should read 30.

In Table 1, for Blue Hill, Mass., departure from normal under Air Mass column headed 4.86 should appear as −.08.

MONTHLY WEATHER REVIEW

Editor, James E. Caskey, Jr.

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A SURFACE MICRO-STUDY OF SQUALL-LINE THUNDERSTORMS

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Manuscript received October 26, 1948

INTRODUCTION

Squall lines have long been respected for the coincidence of their passage with storms of great intensity. Usually associated with a cyclonic wave system having considerable intensity of its own, they are frequently overlooked or incorrectly located on a synoptic map because of the presence of this parent system. However, the passage of a squall line is in most cases marked by severe weather, while the surface cold front may pass later on with comparatively mild activity. Apparently, great forces exist in the squall line, but in spite of its importance, a detailed analysis of the surface weather phenomena accompanying its passage has not been possible by ordinary methods of macro-analysis. However, utilization of data from the automatic weather stations in the closely-spaced network of the U. S. Weather Bureau's Cloud Physics Project [1] at Wilmington, Ohio, has now made possible a detailed analysis of a number of squall-line thunderstorms. This paper is a presentation of the results of this micro-study of squall lines which passed over the network during an 8-month period of its operation.

Inasmuch as squall lines are frequently difficult to detect on synoptic maps it is also difficult to rigorously define them. However, for the purpose of this study, the following conditions were considered necessary and sufficient to constitute a squall line: (1) A narrow zone of activity usually parallel or nearly parallel to a surface cold front, and occurring usually some distance (e. g., 100 to 200 miles) in advance of it; (2) activity along this line characterized by thunderstorms, severe rain, brief wind shifts, gusty winds, abrupt pressure rises, and abrupt temperature falls.

In order to study the surface phenomena of squall lines critically, it was necessary to view them under magnification and in slow motion, which was made possible through the mechanically recorded data of the 55 surface weather observing stations of the Cloud Physics network. These stations were spaced in checkerboard fashion at 2-mile intervals over a rectangular area measuring 8 miles in an east-west direction by 20 miles in a north-south direction and were in continuous operation from February through September 1948. Continuous records of pressure, temperature, relative humidity, time and amount of rainfall, wind direction, and wind velocity were recorded on instruments equipped with high-speed gears and charts with expanded time scales. Since a low viscosity oil was used in the dash pots of the microbarographs, even short-interval pressure changes were not damped out. From these charts [2] data could be evaluated for any minute of the 24-hour day, and micro-synoptic surface maps could be constructed from the evaluations at frequent intervals.[1] Photographs of typical chart records from the hygrothermograph, microbarograph, rain gage, wind direction recorder, and wind velocity recorder are shown, respectively, in figures 1, 2, 3, 4, and 5.

From these graphical records for the 8 months in which the Wilmington surface network was in operation, it was possible to distinguish 11 weather situations which fulfilled the requirements of the definition of a squall line. Seven squall-line passages were analyzed in detail, with some of the results summarized in Table 1.

It goes almost without saying that thunderstorms occurred along each of these squall lines, although they could not be identified from the graphical records. However, for each of the 11 cases of squall-line passage which were analyzed, there was verification in the reports from the Clinton County Air Force Base weather station and other nearby stations that thunderstorms occurred at corresponding times.

[1] A current, independent investigation using the data on which this article is based indicates that the analysis of the micro-synoptic maps is open to some variable interpretation due to the large speed of motion of the system and the rapid fluctuations of the various meteorological elements. The speed of the system introduces difficulties in picking off from the continuous record charts the exact values of the respective elements at the time indicated, and the rapid fluctuations (particularly those of less than 5 minutes duration—see fig. 2) might be completely missed in synoptic maps spaced 5 minutes apart. However, for the purposes of this paper, the maps indicate very clearly the general features of the phenomenon discussed.—Editor.

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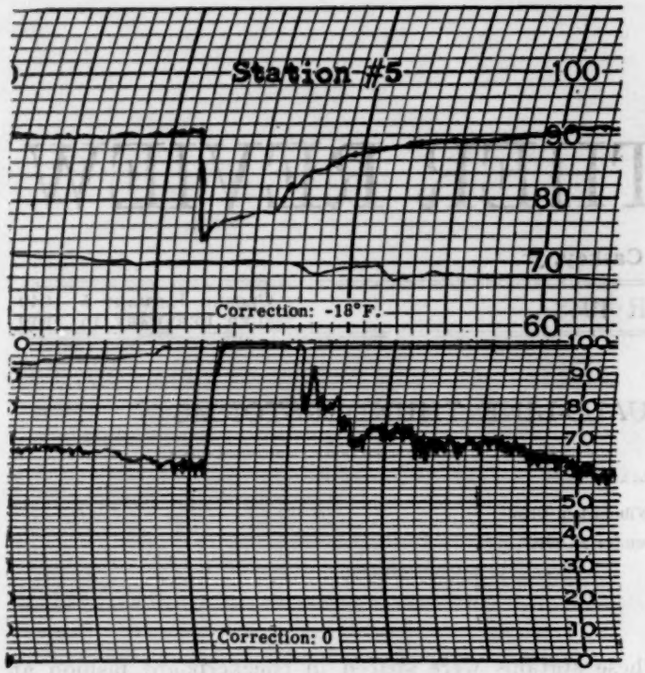

FIGURE 1.—Thermograph (upper trace) and hydrograph (lower trace) records from 1300 to 1600 E. S. T., for March 19, 1948.

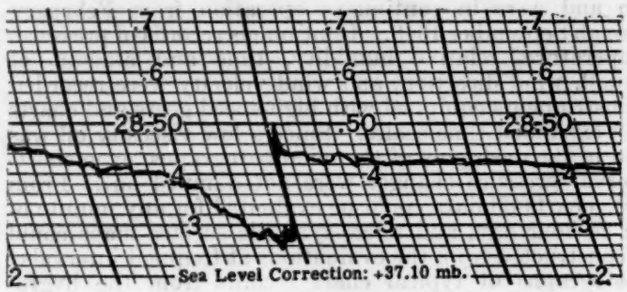

FIGURE 2.—Microbarograph record (lower trace) from 1245 to 1545 E. S. T., for March 19, 1948.

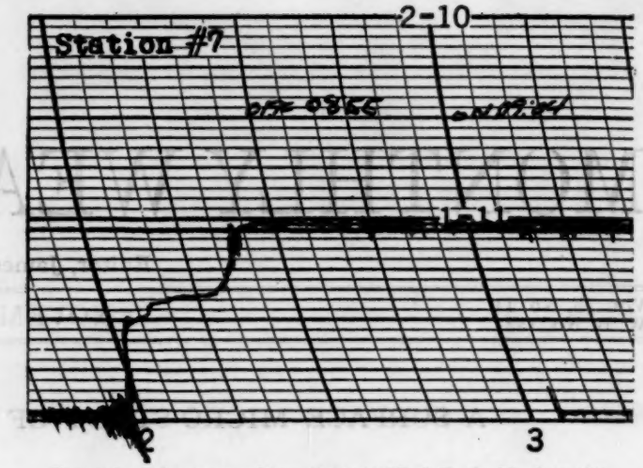

FIGURE 3.—Rain gage record from 1345 to 1515 E. S. T., for March 19, 1948.

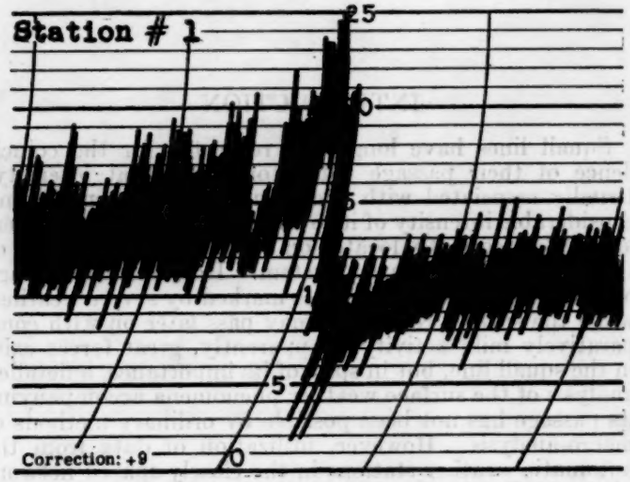

FIGURE 4.—Wind direction record from 1245 to 1445 E. S. T., for March 19, 1948.

TABLE 1.—*Summary of analytical data collected from micro-analysis of seven squall-line passages*

Features of micro-study	Feb. 27 2115 E. S. T.	Mar. 19 1400 E. S. T.	Mar. 31 1445 E. S. T.	May 4 1615 E. S. T.	May 16 2200 E. S. T.	June 7 1930 E. S. T.	June 29 1200 E. S. T.	Average or prevailing case
GENERAL SYNOPTIC CONDITIONS								
Was squall line evident on U. S. surface map?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Was squall line associated with a cyclonic wave system?	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes
Was squall line associated with a surface cold front?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
APPEARANCE ON MICRO-ANALYSIS								
Was squall line a uniform straight or curving line?	No	No	No	No	No	No	No	No
Did squall line move in a uniform manner?	No	No	No	No	No	No	No	No
Did micro-waves form on the squall line?	No	Yes	No	No	No	Yes	No	No
CONDITIONS IN THE MICRO-ANALYSIS								
Wind:								
Direction from which squall line moved	W.	WNW.	WNW.	W.	NW.	NW.	SSW.	WNW.
Average speed of movement (mph)	40	45	35	40	45	45	40	40
Did wind shift appreciably upon squall-line passage?	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes
Was a peak gust associated with squall-line passage?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Maximum value of peak gust (mph)	46	78	52	43	56	51	70	56
Pressure:								
Maximum gradient behind squall line (mb/mi)	1.0	2.0	1.0	1.3	1.7	1.2	1.0	1.3
Maximum isallobaric rise behind line (mb/5 min)	2.6	5.6	2.0	2.4	3.0	2.4	2.4	2.9
Did a micro-high or micro-ridge follow the squal line?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Was a micro-low present on squall line?	No	Yes	No	No	No	Yes	No	No
Precipitation:								
Did precipitation occur ahead of squall line?	No	No	No	Yes	No	Yes	No	No
Did precipitation occur behind squall line?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Maximum rainfall (in/5 min)	0.35	0.60	0.22	0.40	0.17	0.48	0.36	0.37
Duration of "severe" rain (minutes)	5-10	10-15	15-20	10-15	15-20	30-35	15-20	16
Duration of total rainfall (minutes)	60-90	25-30	40-45	45-60	25-30	40-45	45-60	45
Temperature:								
Did temperature fall behind the squall line?	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Did temperature rise behind the squall line?	Yes	No	No	No	No	No	No	No
Maximum amount temperature rose or fell (°F.)	4	17	16	4	12	12	18	15

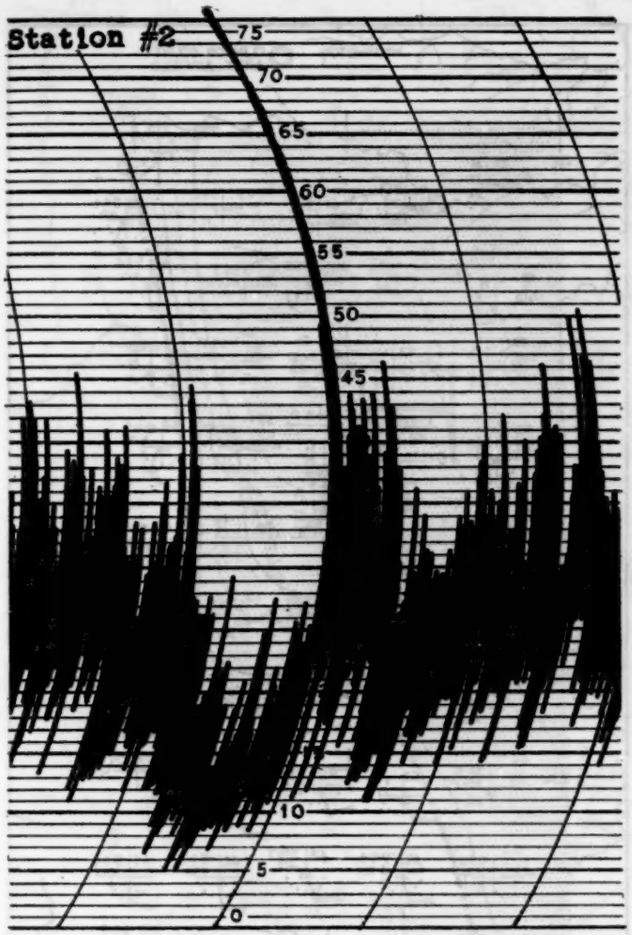

FIGURE 5.—Wind speed record for 1245 to 1445 E. S. T., for March 19, 1948.

METHOD OF MICRO-ANALYSIS

In the interest of analyzing the surface data in slow motion, a series of micro-synoptic surface maps was prepared for each squall-line passage, with the maps in each series drawn for successive 5-minute intervals. In the interest of magnification, the maps used were on a scale of ½ inch equal to 1 mile.[2] Data were plotted on them in the usual manner for synoptic maps, with the following exceptions: (a) isallobaric characteristics and amounts were for 5-minute intervals instead of for the customary 3-hour interval, since pressure changes occur so rapidly along the squall line that the longer interval did not give a descriptive tendency; (b) rainfall intensities and amounts were for 5-minute intervals. Isobars were drawn for each whole millibar, and isallobars were drawn for each whole millibar of change per 5 minutes. The leading edge of squall-line activity was indicated as a series of broken, dash-dot lines. Areas of high and low pressure were labeled, and regions where rain was falling were shaded.

[2] Reproductions are on the scale of ¼ inch equal to 1 mile, due to the necessity of reducing them in size for inclusion in this booklet.

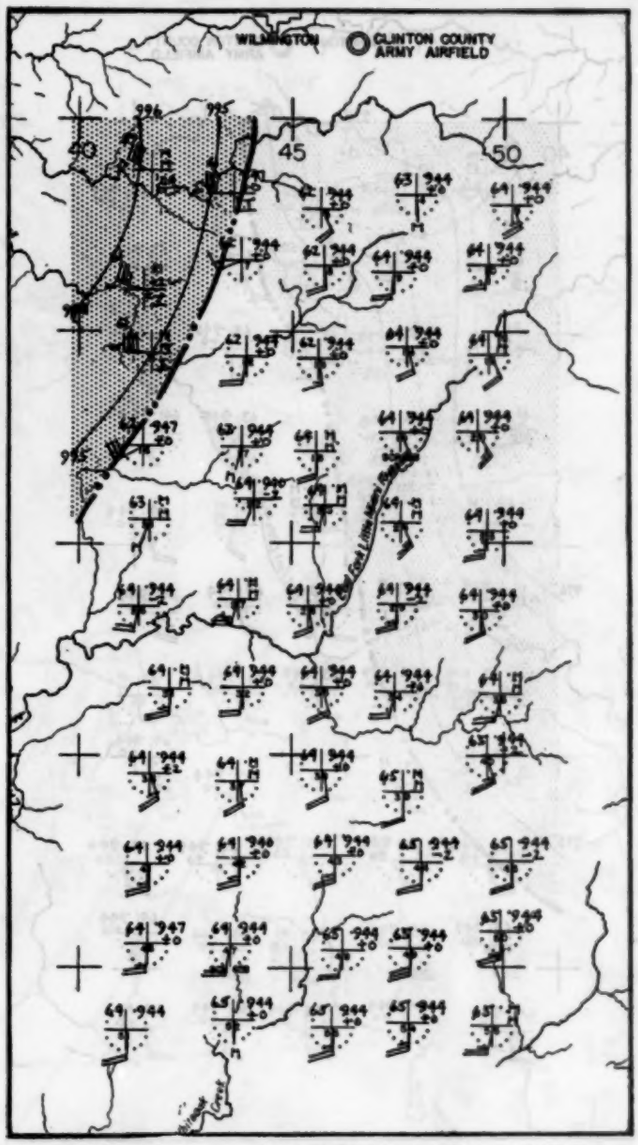

FIGURE 6.—Surface micro-synoptic map for Wilmington Ohio area, 1440 E. S. T., March 31, 1948.

Examples of these micro-synoptic surface maps are shown for two squall-line passages. The series for the typical one which occurred on March 31, 1948, is reproduced in figures 6, 7, and 8. In addition, a section of the regular United States synoptic map [3] for 1330 E. S. T. of the same day is reproduced in figure 9 to indicate the general synoptic pattern for the Wilmington (ILN), Ohio, area. The second series represents the unusually severe squall-line passage of March 19, 1948 (figs. 10, 11, and 12). Property damage of considerable amount resulted from this storm. Figure 13 is included to show a section of the regular United States synoptic map [3] for 1330 E. S. T. of the same day, indicating the general synoptic pattern for the area.

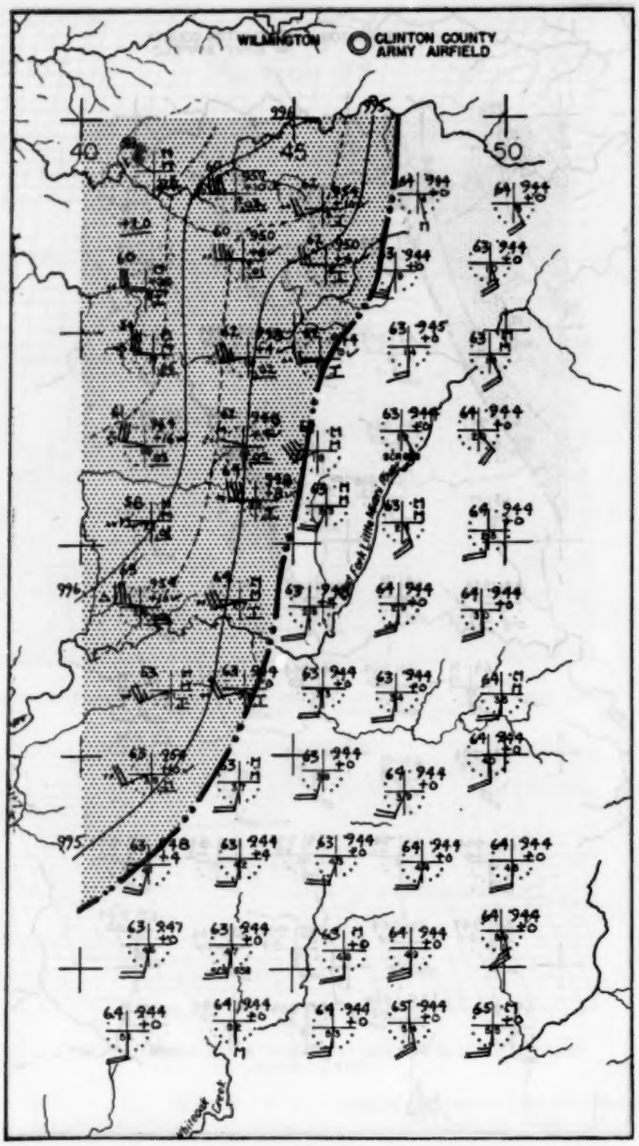

FIGURE 7.—Surface micro-synoptic map for Wilmington Ohio area, 1445 E. S. T., March 31, 1948.

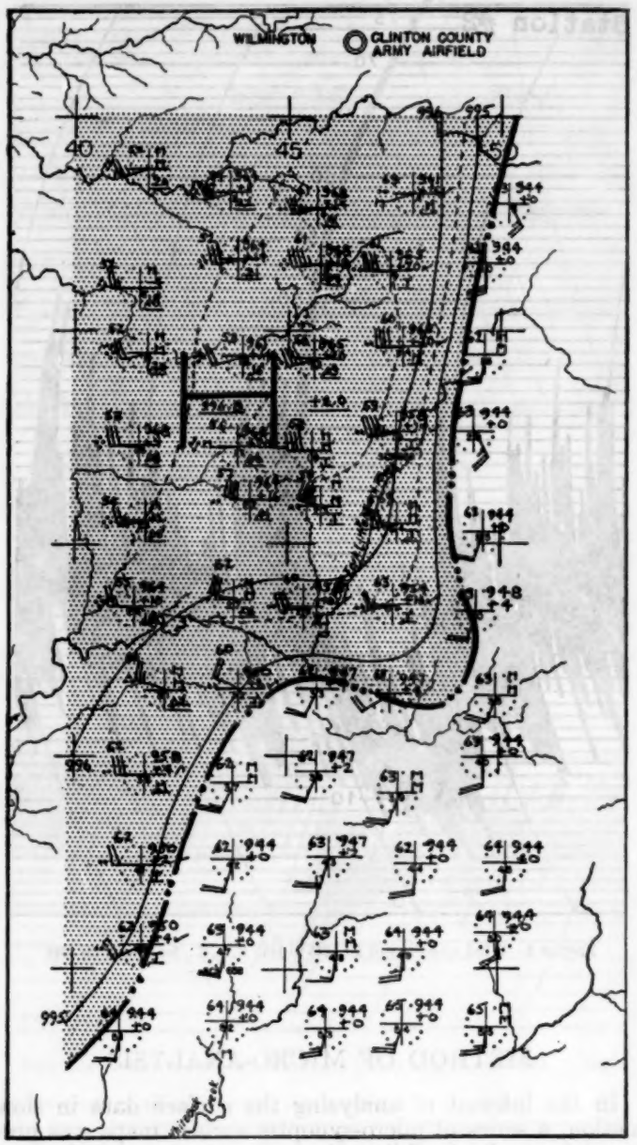

FIGURE 8.—Surface micro-synoptic map for Wilmington Ohio area, 1450 E. S. T., March 31, 1948.

RESULTS OF MICRO-STUDY

From the study of the 11 recognizable squall-line passages and the micro-anylysis of 7 of them, a number of generalizations have been made and are presented in the following paragraphs.

DIURNAL AND SEASONAL OCCURRENCE

From the graphical records it was found that all of the squall-line passages occurred between the hours of 0600 and 2200 E. S. T. and none occurred during the early morning hours. Of the 7 which were analyzed, all occurred between the hours of 1200 and 2200 E. S. T. Therefore, although an insufficient number of cases were studied to constitute proof of the statement, it appears that severe storms associated with squall-line passages in the Ohio region are most likely to occur during afternoon and evening hours.

These passages were well distributed throughout the period from February 27 to June 29, except that none occurred during April. The seven which were analyzed in detail occurred on February 27, March 19, March 31, May 4, May 16, June 7, and June 29. The other four occurred on March 2, March 15, May 2, and June 6. No recognizable ones occurred after June 29. In other words, all of the squall-line passages which were identified occurred in late winter, spring, and early summer.

RELATION TO FRONTAL SYSTEM

It is not within the scope of this paper to theorize on the origin of squall lines nor to speculate on their upper-air structure. However, some mention can be made in regard to the recent surface history of the 11 which were studied. In all cases except one the squall line was associated with a major cyclonic wave system which was present on the surface synoptic map; usually the line of activity appeared at some distance in advance of the surface cold front. However, micro-analysis of the line of activity yielded similar results in all cases, regardless of its relation to the general synoptic situation.

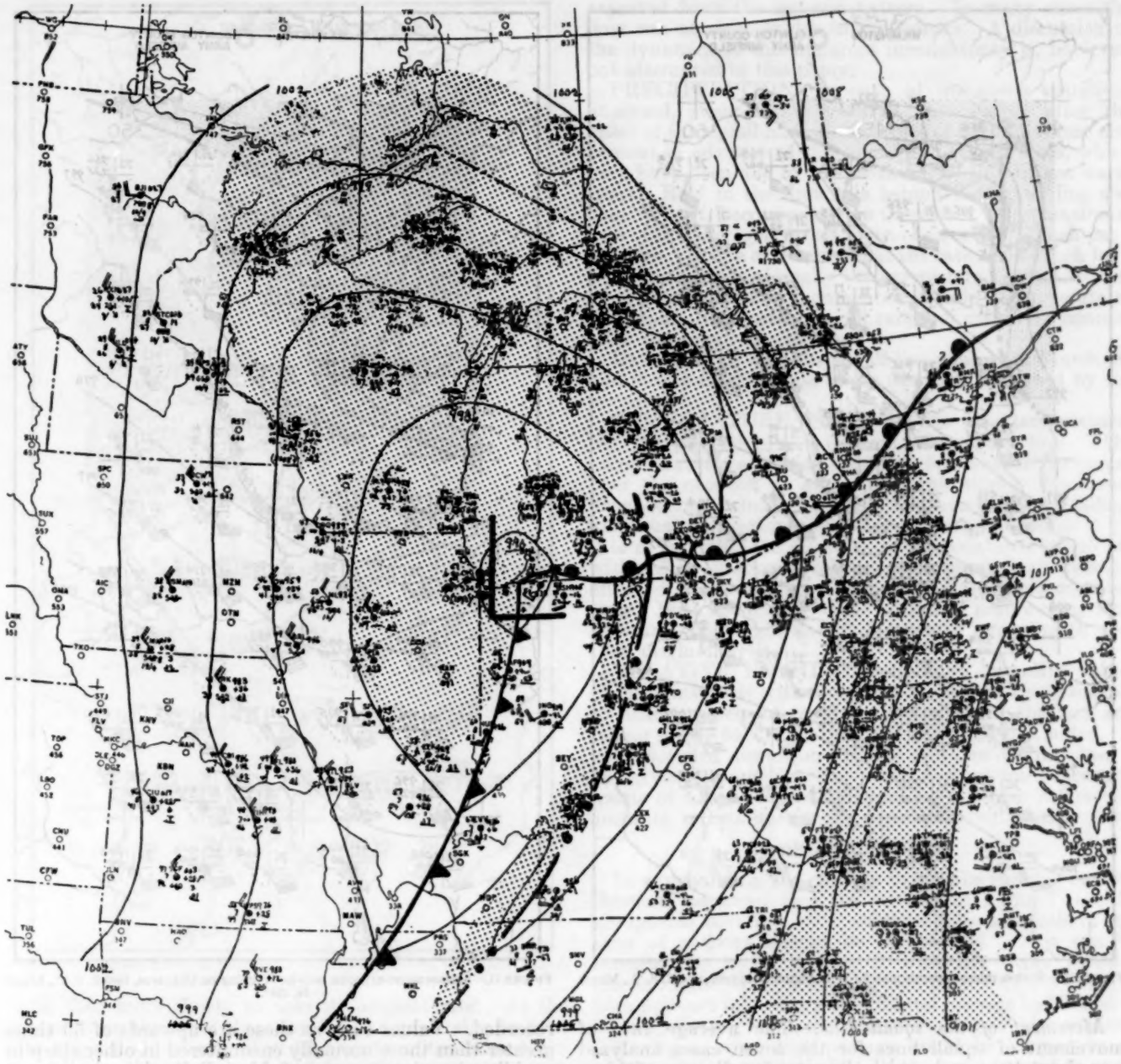

FIGURE 9.—Section of United States surface synoptic map for 1330 E. S. T., March 31, 1948.

METEOROLOGICAL FEATURES OF SQUALL LINES

Pattern of the squall line.—On regular surface synoptic maps, squall lines are indicated as straight or gently curving lines moving uniformly across the map. From the micro-analysis, it was determined that this is not representative. On the micro-synoptic maps, none of the seven cases of squall lines were represented by straight lines, nor did the lines of activity move uniformly across the network on the series of maps for each case. Small sections of the line accelerated or slowed down; surges occurred here and there. Although the lines were continuous and sharply defined, their progress was jumpy.

Formation of micro-lows.—In two of the seven cases which were analyzed, it was found that small low centers, or micro-lows, developed along the squall lines. At the center of the micro-low, the squall line developed a small perturbation, or micro-wave, which in one case actually occluded and then dissipated. In the other case (storm of March 19, 1948) it flattened out when the micro-low containing it filled. Property damage in the latter storm was considerable, with roofs ripped from some buildings, others blown down, trees blown over, and a covered bridge damaged. The damage was greatest along the path traversed by this micro-wave. Again, there was an insufficient number of cases to make any generalization concerning the formation of these micro-waves, but it is likely that they form from time to time along squall lines and last probably no more than 30 minutes before they disappear.

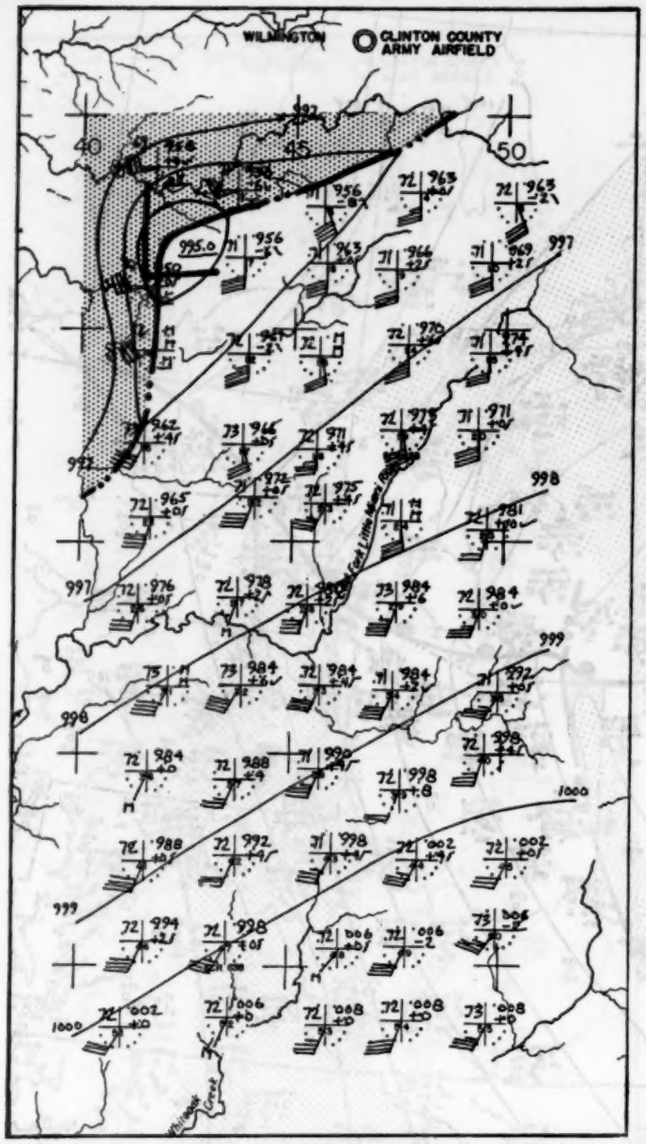

FIGURE 10.—Surface micro-synoptic map for Wilmington Ohio area ,1355 E. S. T., March 19, 1948.

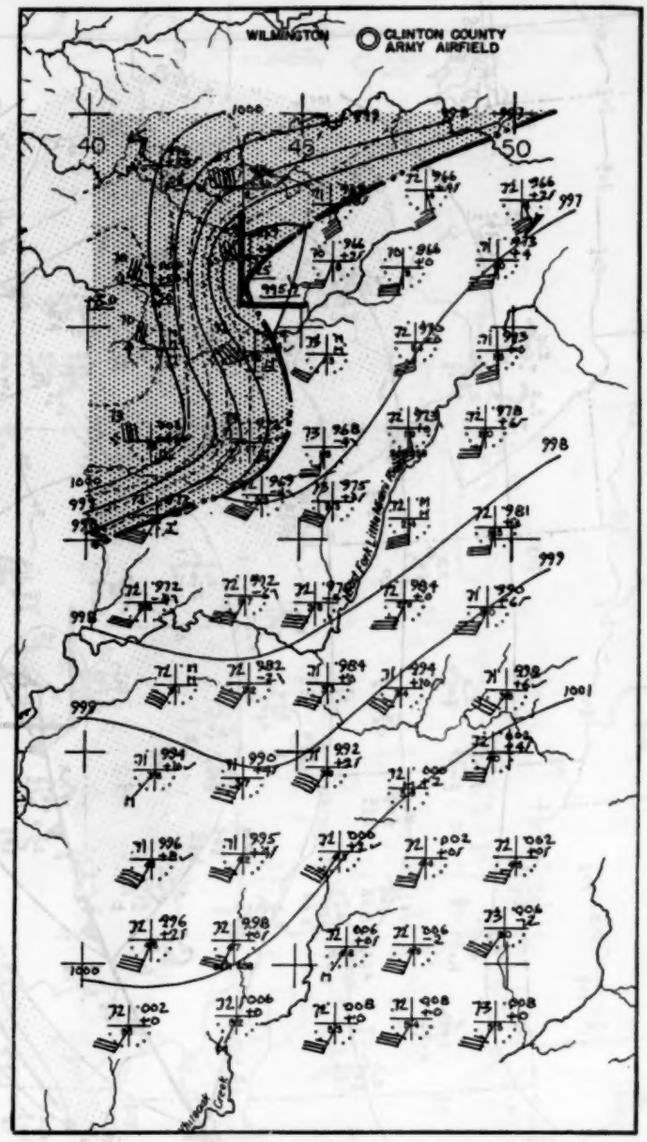

FIGURE 11.—Surface micro-synoptic map for Wilmington Ohio area, 1400 E. S. T., March 19, 1948.

Movement of the squall line.—The average rate of movement of squall lines for the seven cases analyzed was about 40 m. p. h., with the rates for all cases within a range of 35 to 45 m. p. h. Small, very local portions of the lines moved faster or slower than the average. During the storm of March 19, for example, the rate of movement of the micro-wave was about 60 m. p. h. for the period from 1400 to 1405 E. S. T.

The direction from which the squall lines moved averaged west-northwest for six of the seven cases analyzed; it varied within the range of west to northwest. The one case in which the line moved from the south-southwest was not considered a typical example, although no explanation can be given for its unorthodox movement.

Accompanying changes in weather elements.—PRESSURE: Immediately upon the passage of a squall line there was an abrupt rise in pressure. The total rise ranged from 2 to 6 mb., and it sometimes occurred within 5 minutes' time. Local gradients were as steep as 1 to 2 mb. per mile. Correspondingly, isallobaric rises were high, with values as great as 5.6 mb. per 5 minutes recorded. Values such as these are upwards of 50 times greater than those normally encountered in other steep or rapidly changing pressure fields. Following the abrupt rise in pressure, there was a leveling off or a slow falling on the graphs. The configuration resulting on the micro-synoptic map was then a micro-high, or micro-ridge, which rose sharply with the onset of the squall line and sloped gently away 5 to 10 miles behind it.

WIND: In all but one case of the seven analyzed, marked wind shifts occurred upon the squall line's passage. Winds ahead of the lines were usually southerly, and an almost instantaneous shift to westerly or north-westerly winds behind it was observed.

Wind speed remained fairly steady until the passage of the squall line, when a peak gust occurred. This gust lasted for only 1 or 2 minutes and the speed was at times as high as 75 m. p. h., although for the seven cases the peak gusts averaged 56 m. p. h. During the storm of March 19, several stations recorded gusts in excess of 75 m. p. h. Following the peak gust and the passage of the squall line, the wind speed decreased, at first rapidly

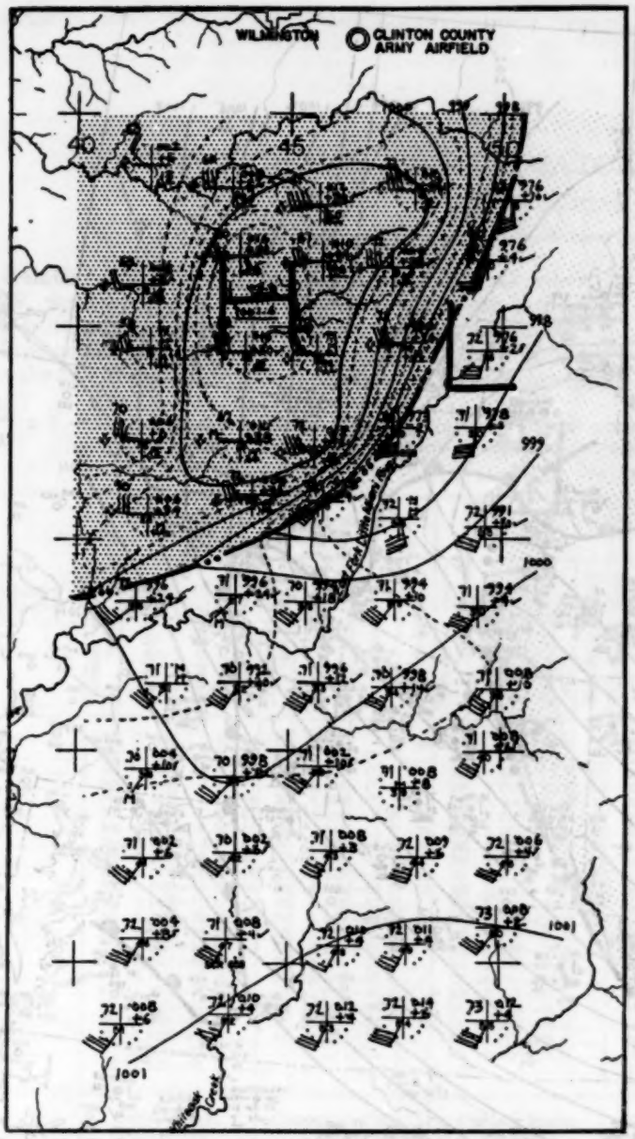

FIGURE 12.—Surface micro-synoptic map for Wilmington Ohio area, 1405 E. S. T., March 19, 1948.

and then more slowly to near its original rate. At the same time the wind direction backed gradually to near its original direction. Ten to twenty miles behind the squall line the wind speed and direction were very much as they had been prior to its passage.

Due to these narrow limitations on the duration of the squall-line wind and to its instantaneous shift, descriptive winds are not often observed at the exact time of the record observations which are plotted on the U. S. synoptic surface map. When an occasional squall-line wind shift is plotted on the map, the analyst frequently disregards it as an "unrepresentative thunderstorm wind." Analysis of these seven cases, however, showed that the wind is highly informative as to the exact position of the line. (Winds associated with a thermal-type thunderstorm do not follow this pattern, so care should be taken in making a map analysis not to confuse a thermal-type thunderstorm with a squall-line thunderstorm; winds of the former blow out in all directions from the storm but do not shift to any particular direction.)

An inspection of the micro-analysis reveals that wind shifts were frequently not as complete as might have been expected from the isobaric pattern. In many cases the flow was at right angles to the isobars. A discussion of the dynamics of this apparent inconsistency is, however, not attempted in this paper.

PRECIPITATION: In each of the seven situations analyzed, precipitation occurred immediately after the onset of the squall line. Small areas of light rain were also present in advance of the squall line in two cases, which may have been due to the proximity of the surface warm front. Rain in the first mile behind the squall line was usually light, becoming severe thereafter. The maximum rate of fall averaged for all seven cases was 0.37 inch per 5 minutes. In one case rain fell at the rate of 0.60 inch for a 5-minute period. Usually the severe rain continued from 10 to 20 minutes and then abated rapidly to moderate or light rain. In most cases, all rain had ceased 45 minutes after the squall-line passage.

Hail occurred with the squall-line passage of March 19, and it was most intense along the path traversed by the micro-wave.

TEMPERATURE: Except for one case, temperatures fell sharply upon the passage of a squall line. (The excepted case was one wherein a surface warm front passed over the network at about the same time.) Maximum drops occurred during the time that severe rain was falling, and usually the amount of the drop was proportional to the rate of rainfall. On an average, temperatures fell 15° F. within 5 or 10 minutes following the squall line's passage, although in one case the drop was 17° F. within 3 minutes' time. With the ending of the period of severe rain, temperatures rose again slowly, frequently returning to near their original levels.

RELATIVE HUMIDITY: Relative humidity values changed inversely with temperature changes, rising sharply to near 100 percent upon the beginning of the rain and falling slowly back to normal when the rain had ended. A more detailed discussion of these and dew point values is not given inasmuch as they were derived from measurements of hair hygrometers which do not give sufficiently accurate measurements for correlation with other data.

CONCLUSIONS

In summarizing the changes in specific surface weather elements accompanying the passage of a squall line, the abruptness, severity, and narrowness characteristic of this zone of activity should be emphasized. This can be brought out by comparing it with any other weather discontinuity; e. g., a surface cold front. If the dome of high pressure following a cold frontal passage be likened to a gently sloping knoll, then the micro-ridge of high pressure following a squall-line passage could be likened to an abrupt, almost vertical cliff. If the knoll be said to cover an area of several thousand square miles then the cliff would, correspondingly, have a width of only a few miles. In fact, the total time covering the passage of the squall line to the return to normal conditions is usually less than 45 minutes. Severe rain is over within 10 to 20 minutes, and all of the rain is over in less than an hour. Wind shifts may last for only 30 minutes, and the peak gust has a duration of only 1 or 2 minutes. Sharp pressure rises are accomplished in 5 or 10 minutes, while pressures may slowly return to normal within an hour. Temperatures fall during the first 5- or 10-minute period and may return to normal within an hour. In general, 1 hour after the squall-line passage conditions may be nearly normal again.

Because of these characteristics, even experienced forecasters have difficulty in locating squall lines when analyzing the synoptic maps by ordinary methods of macro-analysis. Although the presence of all 11 squall lines was evident on the surface synoptic maps of the

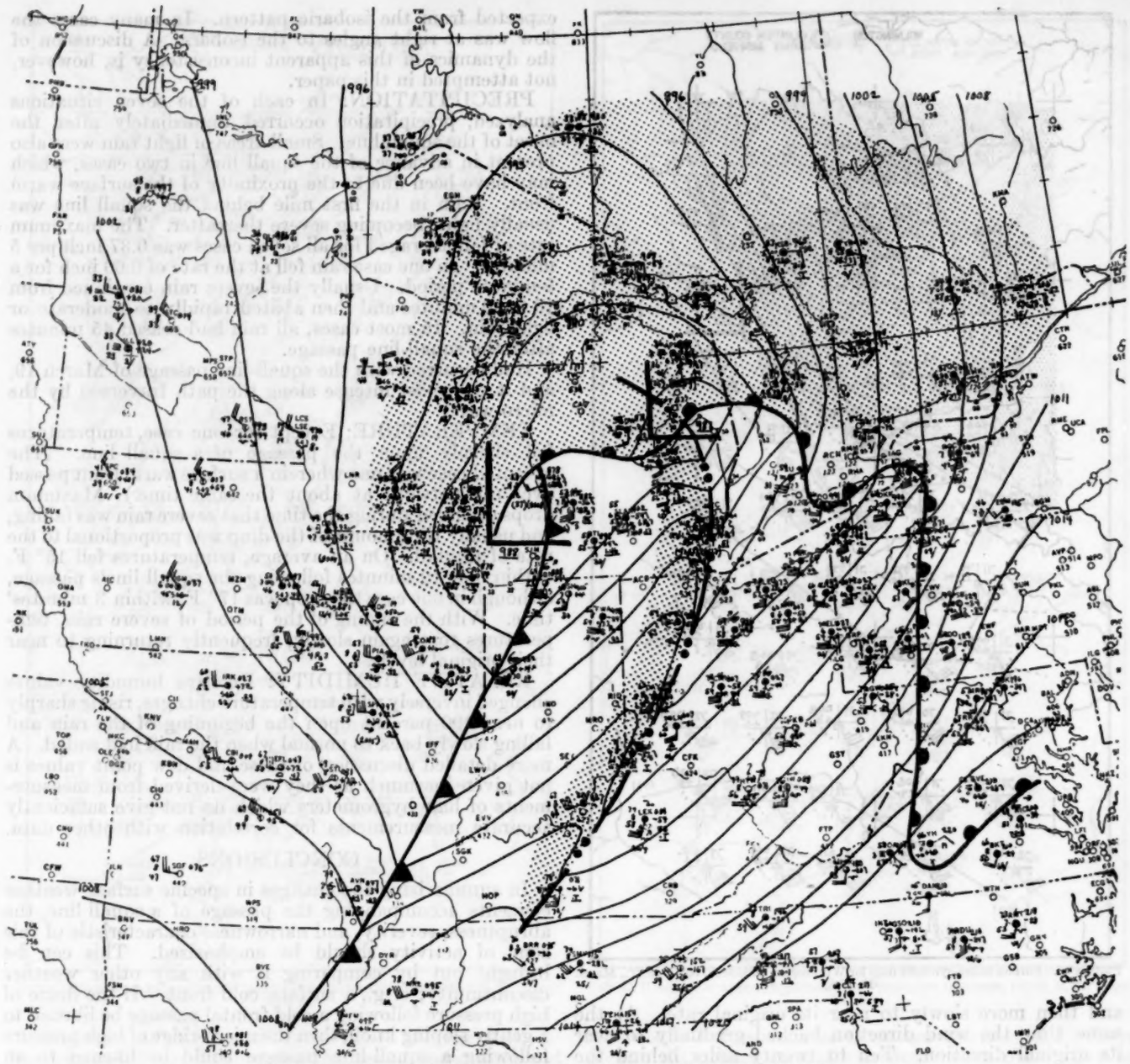

FIGURE 13.—Section of United States surface synoptic map for 1330 E. S. T., March 19, 1948.

United States prepared by the Weather Bureau-Air Force-Navy Analysis Center at Washington, D. C., in a few cases they had been incorrectly located or they were dropped too soon from the maps.

A single observer has even less chance of reporting descriptive weather data for identifying the squall line at any regular 3- or 6-hourly observation. Due to the abruptness of the changes, the more frequent hourly observations may miss the storm. In an exceptional case, when a synoptic observation is taken during a squall-line passage, the data reported by a single observer—especially wind, pressure, and pressure tendency—may appear so confusing to the person analyzing the synoptic map that he does not use the reports. Generally, it may be said that attempting to report or identify a squall-line passage by ordinary methods is like trying to photograph a flying airplane with a time-exposure camera.

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*2. 1948 Surface Observational Data from the Surface Observation Network, U. S. Weather Bureau Cloud Physics Project, Wilmington, Ohio. (Unpublished)

*3. Manuscript Surface Synoptic Charts for 1948, WBAN Analysis Center, U. S. Weather Bureau, Washington, D. C. (Unpublished)

*Information concerning the availability of these data may be obtained from the Scientific Services Division, U. S. Weather Bureau, Washington, D. C.

METEOROLOGICAL AND CLIMATOLOGICAL DATA FOR NOVEMBER 1948

AEROLOGICAL OBSERVATIONS

[For description of change in Table 1 and charts, see REVIEW, January 1946, p. 6]

Relative humidity data, beginning with October 1, 1948, were computed, and expressed in these tables, on the basis of the vapor pressure over water. Upper air values of relative humidity at levels with temperatures less than 0° C. have formerly been computed and expressed on the basis of the vapor pressure over ice. Therefore, relative humidity data for the period after October 1, 1948, should not be combined with earlier data without necessary conversion.

TABLE 1.—*Mean dynamic height (geopotential) in units of 0.98 dynamic meter, temperature in degrees centigrade, and relative humidity in percent, for standard pressures, as obtained by radiosondes during November 1948*

STATIONS AND MEAN SURFACE PRESSURES

Standard pressure surface (mb.)	Albany, N. Y. (1,006.7 mb.)				Albuquerque, N. Mex. (837.1 mb.)				Atlanta, Ga. (981.8 mb.)				Big Spring, Tex. (926.4 mb.)				Bismarck, N. Dak. (952.1 mb.)				Boise, Idaho (919.6 mb.)				Brownsville, Tex. (1,013.8 mb.)			
	Number of observations	Dynamic height	Temperature	Relative humidity	Number of observations	Dynamic height	Temperature	Relative humidity	Number of observations	Dynamic height	Temperature	Relative humidity	Number of observations	Dynamic height	Temperature	Relative humidity	Number of observations	Dynamic height	Temperature	Relative humidity	Number of observations	Dynamic height	Temperature	Relative humidity	Number of observations	Dynamic height	Temperature	Relative humidity
Surface	30	86	6.4	81	30	1,620	5.4	35	30	300	12.1	81	30	774	9.4	43	30	505	−0.9	80	30	868	3.8	69	30	6	18.7	80
1,000	30	141	7.0	74	30	138	(*)	----	30	145	(*)	----	30	127	(*)	----	30	109	(*)	----	30	178	(*)	----	30	123	20.0	74
950	30	566	6.1	71	30	574	(*)	----	30	578	13.0	69	30	562	(*)	----	30	524	−2.0	74	30	605	(*)	----	30	569	18.3	68
900	30	1,004	4.0	71	30	1,026	(*)	----	30	1,031	12.0	66	30	1,015	11.5	35	30	954	−.9	68	30	1,043	5.0	54	30	1,028	16.1	61
850	30	1,467	1.9	68	30	1,494	(*)	----	30	1,509	11.4	56	30	1,491	10.0	31	30	1,409	−2.6	64	30	1,507	2.3	55	30	1,513	14.6	52
800	30	1,955	.2	62	30	1,990	4.8	36	30	2,015	9.8	50	30	1,992	7.1	31	30	1,888	−4.5	58	30	1,994	−1.2	57	30	2,025	13.6	49
750	30	2,477	−1.3	52	30	2,519	1.8	39	30	2,555	7.6	46	30	2,529	4.8	30	30	2,400	−7.1	56	30	2,510	−4.4	58	30	2,574	11.8	38
700	30	3,017	−3.9	47	30	3,066	−1.5	37	30	3,114	4.9	42	30	3,079	1.8	33	30	2,928	−10.2	53	30	3,046	−7.6	62	29	3,140	9.3	37
650	30	3,605	−6.3	45	30	3,653	−5.2	41	30	3,716	1.9	41	30	3,679	−1.8	31	30	3,502	−13.5	52	30	3,622	−10.3	58	29	3,752	5.6	37
600	30	4,222	−9.6	44	30	4,275	−9.2	43	30	4,357	−1.8	----	30	4,304	−5.9	----	30	4,100	−17.2	50	30	4,232	−14.0	55	29	4,400	2.1	----
550	30	4,895	−13.2	44	30	4,944	−13.3	35	29	5,045	−5.8	----	30	4,985	−10.0	----	30	4,752	−20.6	----	30	4,890	−18.2	52	29	5,097	−2.4	----
500	30	5,609	−17.4	41	30	5,662	−17.5	----	27	5,785	−10.0	----	30	5,710	−14.6	----	30	5,448	−24.9	----	29	5,597	−22.3	----	29	5,846	−7.2	----
450	30	6,398	−22.5	----	30	6,450	−22.2	----	27	6,596	−15.4	----	30	6,504	−19.3	----	30	6,208	−30.0	----	29	6,369	−27.0	----	29	6,667	−12.5	----
400	30	7,246	−28.2	----	30	7,300	−27.8	----	27	7,469	−21.5	----	29	7,375	−24.9	----	29	7,038	−36.0	----	29	7,205	−31.9	----	29	7,545	−18.8	----
350	30	8,190	−34.9	----	30	8,247	−34.2	----	27	8,439	−28.8	----	29	8,334	−31.3	----	29	7,952	−42.4	----	29	8,134	−38.6	----	29	8,529	−25.6	----
300	30	9,249	−41.9	----	29	9,313	−40.2	----	26	9,524	−36.8	----	29	9,410	−38.2	----	29	8,979	−48.6	----	29	9,177	−45.3	----	29	9,629	−33.6	----
250	30	10,463	−49.5	----	28	10,545	−47.4	----	26	10,761	−46.0	----	29	10,643	−46.1	----	28	10,162	−52.0	----	29	10,375	−52.0	----	29	10,882	−43.1	----
200	30	11,897	−57.4	----	27	12,003	−53.2	----	25	12,209	−55.1	----	29	12,100	−53.8	----	26	11,603	−51.7	----	27	11,801	−56.7	----	29	12,348	−54.6	----
175	29	12,738	−59.9	----	26	12,862	−55.9	----	23	13,052	−59.9	----	29	12,951	−57.6	----	26	12,468	−52.0	----	23	12,634	−57.0	----	27	13,189	−60.9	----
150	28	13,686	−61.2	----	24	13,831	−59.7	----	23	14,003	−64.5	----	27	13,908	−61.5	----	25	13,468	−52.5	----	22	13,595	−57.9	----	25	14,135	−66.3	----
125	22	14,830	−62.1	----	17	14,975	−62.8	----	21	15,112	−67.8	----	22	15,032	−64.8	----	23	14,637	−53.2	----	20	14,739	−59.2	----	23	15,228	−71.1	----
100	17	16,204	−63.8	----	----	----	----	----	10	16,449	−70.4	----	14	16,363	−67.4	----	16	16,039	−53.7	----	14	16,137	−61.3	----	20	16,539	−74.5	----
80	6	17,520	−61.7	----	----	----	----	----	----	----	----	----	8	17,726	−64.7	----	----	----	----	----	7	17,496	−59.8	----	12	17,860	−72.7	----

Standard pressure surface (mb.)	Buffalo, N. Y. (988.4 mb.)				Camaguey, Cuba [2] (mb.)				Caribou, Maine (993.2 mb.)				Charleston, S. C. (1,015.9 mb.)				Ciudad Victoria, Mex. (975.2 mb.)				Columbia, Mo. (983.7 mb.)				Dodge City, Kans. (922.0 mb.)			
	Number of observations	Dynamic height	Temperature	Relative humidity	Number of observations	Dynamic height	Temperature	Relative humidity	Number of observations	Dynamic height	Temperature	Relative humidity	Number of observations	Dynamic height	Temperature	Relative humidity	Number of observations	Dynamic height	Temperature	Relative humidity	Number of observations	Dynamic height	Temperature	Relative humidity	Number of observations	Dynamic height	Temperature	Relative humidity
Surface	30	221	8.0	75	----	----	----	----	30	191	1.7	87	30	13	15.6	88	29	335	20.3	61	30	239	7.4	73	28	792	4.4	68
1,000	30	123	(*)	----	----	----	----	----	30	134	(*)	----	30	147	17.3	82	29	116	(*)	----	30	102	(*)	----	28	120	(*)	----
950	30	553	7.4	69	----	----	----	----	30	550	1.4	77	30	588	16.5	75	29	563	19.6	57	30	530	7.9	64	28	548	(*)	----
900	30	990	5.1	68	----	----	----	----	30	983	−.5	73	30	1,045	14.8	66	29	1,025	16.6	59	30	971	5.9	60	28	989	6.4	54
850	30	1,455	2.4	67	----	----	----	----	30	1,439	−1.9	71	30	1,528	13.2	62	28	1,509	14.1	61	30	1,437	3.8	57	28	1,457	5.1	44
800	30	1,942	−.2	62	----	----	----	----	30	1,919	−3.8	65	30	2,037	11.4	53	28	2,020	13.0	58	30	1,928	1.6	51	28	1,949	2.8	42
750	30	2,465	−2.0	54	----	----	----	----	30	2,431	−5.7	63	30	2,578	8.9	48	28	2,567	11.9	56	30	2,451	−1.1	48	28	2,472	.2	38
700	30	3,004	−4.3	50	----	----	----	----	30	2,966	−7.8	58	30	3,144	6.1	45	28	3,135	9.0	51	30	2,994	−3.0	44	28	3,019	−3.0	39
650	30	3,593	−6.8	49	----	----	----	----	30	3,544	−10.2	49	30	3,749	2.7	44	27	3,753	5.1	46	30	3,584	−5.6	42	28	3,606	−5.9	37
600	30	4,207	−9.8	42	----	----	----	----	30	4,154	−13.1	47	30	4,391	−.9	46	27	4,402	1.6	----	30	4,202	−9.2	43	28	4,225	−9.8	39
550	30	4,877	−13.9	41	----	----	----	----	30	4,812	−16.8	46	29	5,077	−4.9	40	27	5,101	−2.7	----	29	4,875	−13.2	39	28	4,893	−14.2	41
500	30	5,591	−18.4	39	----	----	----	----	30	5,521	−21.3	----	29	5,824	−9.3	35	26	5,847	−7.6	----	29	5,591	−17.9	38	28	5,607	−19.2	41
450	29	6,380	−23.1	----	----	----	----	----	30	6,291	−26.6	----	29	6,638	−14.6	36	26	6,668	−12.9	----	29	6,378	−23.2	----	28	6,388	−24.9	----
400	29	7,225	−28.8	----	----	----	----	----	29	7,135	−32.4	----	28	7,515	−20.7	----	26	7,548	−19.2	----	29	7,224	−28.8	----	28	7,227	−36.0	----
350	28	8,166	−35.2	----	----	----	----	----	29	8,065	−38.2	----	28	8,489	−27.3	----	26	8,528	−26.3	----	29	8,167	−34.6	----	28	8,164	−37.3	----
300	27	9,230	−41.8	----	----	----	----	----	29	9,111	−44.3	----	28	9,581	−35.3	----	26	9,625	−34.4	----	29	9,229	−40.9	----	28	9,218	−42.9	----
250	27	10,445	−49.1	----	----	----	----	----	26	10,304	−50.6	----	27	10,822	−45.3	----	26	10,874	−44.7	----	27	10,452	−47.9	----	27	10,424	−49.5	----
200	23	11,868	−54.5	----	----	----	----	----	19	11,699	−53.4	----	26	12,272	−56.3	----	26	12,328	−57.1	----	23	11,903	−53.7	----	24	11,862	−53.4	----
175	15	12,687	−56.3	----	----	----	----	----	17	12,537	−54.2	----	26	13,109	−61.5	----	26	13,160	−63.7	----	17	12,772	−56.4	----	24	12,718	−55.0	----
150	7	13,597	−56.5	----	----	----	----	----	13	13,503	−54.7	----	24	14,064	−65.9	----	24	14,092	−69.6	----	10	13,755	−57.4	----	23	13,689	−57.6	----
125	----	----	----	----	----	----	----	----	12	14,642	−56.5	----	16	15,159	−69.1	----	17	15,183	−74.5	----	5	14,950	−59.5	----	20	14,834	−61.1	----
100	----	----	----	----	----	----	----	----	5	16,033	−55.9	----	10	16,474	−71.6	----	8	16,464	−77.1	----	----	----	----	----	16	16,183	−63.0	----
80	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	8	17,568	−62.5	----

See footnotes at end of table.

TABLE 1.—*Mean dynamic height (geopotential) in units of 0.98 dynamic meter, temperature in degrees centigrade, and relative humidity in percent, for standard pressures, as obtained by radiosondes during November 1948*—Continued

Standard pressure surface (mb.)	El Paso, Tex. (881.6 mb.)				Ely, Nev. (810.4 mb.)				Glasgow, Mont. (936.5 mb.)				Grand Junction, Colo. (854.0 mb.)				Great Falls, Mont. (884.0 mb.)				Greensboro, N. C. (985.8 mb.)				Hatteras, N. C. (1,017.6 mb.)			
	Number of observations	Dynamic height	Temperature	Relative humidity	Number of observations	Dynamic height	Temperature	Relative humidity	Number of observations	Dynamic height	Temperature	Relative humidity	Number of observations	Dynamic height	Temperature	Relative humidity	Number of observations	Dynamic height	Temperature	Relative humidity	Number of observations	Dynamic height	Temperature	Relative humidity	Number of observations	Dynamic height	Temperature	Relative humidity
Surface	30	1,195	9.7	29	30	1,908	−0.8	56	30	648	0.1	74	30	1,474	0.3	59	30	1,128	2.1	53	30	273	9.8	84	30	3	17.1	86
1,000	30	129	(*)	----	30	185	(*)	----	30	116	(*)	----	30	185	(*)	----	30	119	(*)	----	30	153	(*)	----	30	152	17.4	80
950	30	572	(*)	----	30	613	(*)	----	30	536	(*)	----	30	611	(*)	----	30	547	(*)	----	30	586	11.6	65	30	588	15.6	73
900	30	1,029	(*)	----	30	1,058	(*)	----	30	967	.9	65	30	1,052	(*)	----	30	986	(*)	----	30	1,034	10.2	64	30	1,046	13.3	65
850	30	1,499	10.4	26	30	1,522	(*)	----	30	1,424	−1.5	60	30	1,511	(*)	----	30	1,443	.8	50	30	1,509	8.9	64	30	1,526	11.4	56
800	30	2,001	7.4	27	30	2,012	1.9	50	30	1,904	−4.6	62	30	1,999	.0	56	30	1,927	−2.7	52	30	2,010	7.9	55	30	2,031	9.7	48
750	30	2,532	4.5	26	30	2,534	−1.2	48	30	2,413	−7.5	60	30	2,517	−2.7	58	30	2,441	−6.3	56	30	2,549	6.3	49	30	2,563	7.7	44
700	30	3,087	1.3	27	30	3,076	−4.5	51	30	2,943	−10.8	57	30	3,058	−6.1	59	30	2,971	−9.7	59	30	3,105	3.8	45	30	3,131	5.2	39
650	30	3,683	−2.2	----	30	3,660	−7.6	51	30	3,515	−13.9	52	30	3,638	−9.2	59	30	3,548	−13.2	62	29	3,705	.8	43	30	3,726	1.7	40
600	30	4,311	−6.0	----	30	4,275	−11.2	48	30	4,113	−17.2	48	30	4,250	−12.3	56	30	4,145	−17.1	61	29	4,344	−2.7	41	30	4,374	−1.7	33
550	30	4,990	−9.6	----	30	4,939	−15.1	45	30	4,764	−21.0	----	30	4,913	−15.7	48	30	4,795	−21.3	----	27	5,028	−6.7	----	30	5,055	−5.8	33
500	30	5,718	−14.0	----	29	5,652	−19.4	43	30	5,458	−25.7	----	29	5,627	−20.1	46	30	5,489	−25.8	----	27	5,766	−11.3	----	30	5,801	−10.4	----
450	30	6,517	−19.2	----	29	6,435	−23.7	----	30	6,218	−31.0	----	29	6,403	−25.1	----	30	6,251	−31.2	----	27	6,576	−16.2	----	30	6,605	−15.8	----
400	30	7,383	−25.7	----	29	7,281	−29.6	----	30	7,039	−37.3	----	29	7,246	−31.1	----	30	7,068	−36.9	----	27	7,446	−22.4	----	29	7,482	−22.0	----
350	30	8,330	−32.4	----	29	8,220	−35.9	----	30	7,949	−43.6	----	29	8,180	−37.2	----	30	7,979	−43.0	----	27	8,412	−29.5	----	28	8,448	−29.1	----
300	30	9,401	−39.4	----	28	9,274	−42.3	----	30	8,970	−49.6	----	29	9,230	−43.4	----	30	9,006	−48.4	----	25	9,499	−37.3	----	27	9,528	−37.4	----
250	28	10,625	−47.5	----	28	10,485	−49.8	----	29	10,145	−53.0	----	28	10,444	−49.9	----	30	10,193	−52.6	----	23	10,735	−46.5	----	26	10,768	−46.3	----
200	26	12,074	−55.8	----	24	11,920	−56.4	----	28	11,578	−53.1	----	26	11,871	−55.4	----	28	11,614	−54.6	----	16	12,169	−58.0	----	24	12,216	−56.5	----
175	25	12,912	−59.6	----	22	12,764	−58.3	----	26	12,429	−52.3	----	23	12,705	−56.0	----	24	12,452	−53.3	----	13	13,006	−60.6	----	22	13,056	−61.0	----
150	24	13,875	−63.5	----	18	13,738	−61.0	----	23	13,427	−52.8	----	17	13,693	−57.8	----	21	13,437	−53.3	----	11	13,944	−64.7	----	19	14,001	−64.7	----
125	21	14,987	−66.2	----	12	14,832	−62.6	----	20	14,590	−53.2	----	14	14,845	−59.6	----	19	14,604	−54.9	----	5	15,036	−66.3	----	16	15,098	−67.5	----
100	17	16,331	−69.6	----	10	16,202	−63.5	----	12	15,998	−52.9	----	9	16,231	−61.7	----	16	16,033	−55.6	----					7	16,446	−69.1	----
80					6	17,568	−61.7	----									10	17,433	−56.5	----								

Standard pressure surface (mb.)	Havana, Cuba [1] (---- mb.)				Honolulu, T. H. (1,013.6 mb.)				International Falls, Minn. (967.7 mb.)				Joliet, Ill. (990.8 mb.)				Lake Charles, La. (1,014.9 mb.)				Lander, Wyo. (826.8 mb.)				Las Vegas, Nev. (951.2 mb.)			
	Number of observations	Dynamic height	Temperature	Relative humidity	Number of observations	Dynamic height	Temperature	Relative humidity	Number of observations	Dynamic height	Temperature	Relative humidity	Number of observations	Dynamic height	Temperature	Relative humidity	Number of observations	Dynamic height	Temperature	Relative humidity	Number of observations	Dynamic height	Temperature	Relative humidity	Number of observations	Dynamic height	Temperature	Relative humidity
Surface	----	----	----	----	30	3	25.0	69	30	360	−1.6	83	30	178	5.5	81	30	5	14.6	82	30	1,696	−1.7	57	30	574	9.8	24
1,000	----	----	----	----	30	121	24.0	69	30	96	(*)	----	30	101	2.6	74	30	130	16.3	72	30	149	(*)	----	30	153	(*)	----
950	----	----	----	----	30	571	20.4	75	30	509	−1.6	83	30	528	5.5	71	30	571	14.6	68	30	573	(*)	----	30	585	(*)	----
900	----	----	----	----	30	1,033	16.8	80	30	935	−3.2	79	30	963	3.4	67	30	1,022	12.5	62	30	1,014	(*)	----	30	1,037	11.6	24
850	----	----	----	----	30	1,520	14.7	71	30	1,387	−4.2	68	30	1,426	1.5	62	30	1,500	10.7	57	30	1,473	(*)	----	30	1,513	8.7	26
800	----	----	----	----	30	2,031	13.0	56	30	1,863	−6.0	62	30	1,912	−.6	57	30	2,004	9.4	51	30	1,960	.2	49	30	2,011	5.6	30
750	----	----	----	----	30	2,577	10.6	49	30	2,374	−8.0	56	30	2,431	−2.6	49	30	2,546	8.3	46	30	2,476	−3.1	48	30	2,545	2.9	30
700	----	----	----	----	30	3,144	7.5	41	30	2,900	−10.5	54	30	2,971	−5.3	45	30	3,107	6.2	40	30	3,017	−6.6	48	30	3,041	.3	30
650	----	----	----	----	30	3,753	4.1	37	30	3,476	−13.4	55	30	3,556	−7.9	38	30	3,713	2.8	----	30	3,598	−10.2	49	30	3,685	−3.0	30
600	----	----	----	----	30	4,397	.4	36	30	4,073	−16.9	52	30	4,168	−11.3	35	30	4,354	−1.1	----	30	4,204	−14.3	49	30	4,311	−6.7	30
550	----	----	----	----	30	5,088	−3.5	----	30	4,725	−20.9	----	29	4,835	−15.1	----	30	5,042	−4.8	----	30	4,856	−18.4	46	30	4,985	−10.7	28
500	----	----	----	----	30	5,831	−8.0	----	30	5,418	−25.3	----	29	5,545	−19.4	----	28	5,786	−9.8	----	30	5,563	−23.0	----	30	5,712	−15.7	----
450	----	----	----	----	30	6,653	−13.5	----	30	6,183	−30.4	----	29	6,325	−24.3	----	28	6,600	−14.8	----	30	6,334	−28.4	----	30	6,501	−21.2	----
400	----	----	----	----	30	7,533	−20.0	----	30	7,002	−36.5	----	29	7,169	−30.0	----	28	7,474	−21.4	----	30	7,162	−34.3	----	30	7,357	−27.5	----
350	----	----	----	----	30	8,510	−26.6	----	30	7,914	−42.9	----	29	8,107	−36.3	----	28	8,444	−28.4	----	30	8,082	−40.8	----	30	8,305	−34.0	----
300	----	----	----	----	30	9,604	−34.8	----	30	8,939	−48.9	----	29	9,161	−42.7	----	28	9,533	−36.2	----	30	9,117	−46.4	----	30	9,368	−41.1	----
250	----	----	----	----	30	10,852	−43.5	----	30	10,126	−51.8	----	29	10,373	−49.4	----	27	10,775	−45.3	----	27	10,321	−51.9	----	28	10,592	−49.4	----
200	----	----	----	----	30	12,319	−53.6	----	28	11,566	−51.7	----	27	11,821	−54.3	----	27	12,228	−56.2	----	25	11,744	−55.4	----	28	12,026	−57.7	----
175	----	----	----	----	29	13,170	−58.6	----	28	12,432	−51.3	----	24	12,658	−55.4	----	27	13,065	−61.7	----	21	12,601	−56.0	----	28	12,862	−60.5	----
150	----	----	----	----	29	14,127	−63.4	----	26	13,429	−51.7	----	20	13,638	−56.2	----	26	14,005	−67.0	----	18	13,565	−56.2	----	27	13,820	−62.6	----
125	----	----	----	----	22	15,226	−67.4	----	22	14,582	−52.6	----	17	14,790	−57.8	----	24	15,095	−71.0	----	11	14,692	−56.0	----	20	14,926	−65.7	----
100	----	----	----	----	19	16,545	−71.2	----	17	16,014	−53.9	----	12	16,194	−60.1	----	14	16,412	−73.9	----					12	16,237	−66.7	----
80	----	----	----	----	17	17,867	−71.5	----	10	17,416	−54.5	----	8	17,570	−61.9	----	6	17,714	−73.2	----								
60	----	----	----	----	11	19,586	−67.1	----	8	19,249	−56.5	----					5	19,436	−68.6	----								
50	----	----	----	----	9	20,708	−62.6	----																				
40	----	----	----	----	7	22,109	−58.0	----																				

Standard pressure surface (mb.)	Little Rock, Ark. (1,004.9 mb.)				Mazatlan, Mex. (1,008.5 mb.)				Medford, Oreg. (975.1 mb.)				Merida, Mex. (1,010.4 mb.)				Miami, Fla. (1,016.6 mb.)				Nantucket, Mass. (1,017.0 mb.)				Nashville, Tenn. (994.4 mb.)			
	Number of observations	Dynamic height	Temperature	Relative humidity	Number of observations	Dynamic height	Temperature	Relative humidity	Number of observations	Dynamic height	Temperature	Relative humidity	Number of observations	Dynamic height	Temperature	Relative humidity	Number of observations	Dynamic height	Temperature	Relative humidity	Number of observations	Dynamic height	Temperature	Relative humidity	Number of observations	Dynamic height	Temperature	Relative humidity
Surface	29	79	10.8	78	30	14	24.3	79	30	401	5.5	84	30	27	25.6	82	30	4	23.5	86	28	14	9.2	89	30	177	10.3	80
1,000	29	119	(*)	----	30	88	23.8	77	30	193	(*)	----	30	118	25.2	82	30	148	23.8	82	28	154	11.1	80	30	129	(*)	----
950	29	555	11.9	64	30	542	22.5	66	30	619	6.7	71	30	570	22.8	82	30	598	21.0	82	28	585	9.5	71	30	561	10.1	65
900	29	1,001	10.0	61	30	1,005	20.7	54	30	1,058	5.2	65	30	1,039	19.9	82	30	1,064	18.5	77	28	1,029	7.3	63	30	1,006	7.9	64
850	29	1,474	8.0	53	30	1,498	18.2	44	30	1,523	2.7	60	30	1,531	17.2	79	30	1,553	16.1	68	28	1,498	5.6	54	30	1,476	6.8	59
800	29	1,973	6.3	46	30	2,014	15.2	40	30	2,012	.7	55	30	2,047	14.6	72	30	2,067	13.8	59	28	1,992	3.7	49	30	1,973	5.3	55
750	29	2,507	4.3	42	30	2,566	11.7	40	30	2,533	−1.8	54	30	2,594	12.4	58	30	2,612	11.3	49	28	2,523	2.3	45	30	2,507	3.6	51
700	29	3,059	2.1	34	30	3,132	8.1	40	30	3,074	−4.0	50	30	3,168	9.7	51	30	3,184	8.4	43	28	3,070	.1	42	30	3,057	1.6	45
650	29	3,661	−.6	37	30	3,742	4.5	38	30	3,660	−7.0	46	30	3,778	6.3	45	30	3,794	5.0	36	28	3,661	−2.9	40	30	3,655	−1.5	43
600	29	4,290	−4.1	38	29	4,388	1.0	----	30	4,276	−10.4	39	30	4,431	1.9	46	30	4,441	1.2	32	27	4,293	−6.6	42	30	4,285	−4.9	42
550	29	4,972	−7.8	34	29	5,085	−3.0	----	30	4,943	−14.5	----	29	5,129	−1.9	39	30	5,137	−2.9	28	24	4,974	−10.4	42	30	4,969	−8.9	34
500	29	5,707	−12.2	30	29	5,831	−7.9	----	30	5,657	−18.6	----	29	5,881	−6.5	35	30	5,885	−7.2	----	24	5,697	−14.9	----	30	5,695	−13.6	31
450	29	6,508	−17.7	----	28	6,652	−13.3	----	30	6,441	−23.5	----	29	6,704	−11.6	----	29	6,707	−12.4	----	24	6,493	−20.1	----	28	6,490	−18.5	----
400	29	7,375	−23.7	----	28	7,530	−19.4	----	30	7,287	−29.1	----	29	7,590	−17.5	----	29	7,590	−18.6	----	23	7,344	−26.4	----	28	7,351	−24.2	----
350	29	8,338	−30.2	----	27	8,510	−26.3	----	30	8,228	−35.8	----	29	8,575	−25.0	----	27	8,570	−25.5	----	23	8,295	−33.1	----	27	8,308	−31.2	----
300	29	9,419	−37.4	----	27	9,607	−34.3	----	30	9,283	−42.7	----	29	9,675	−33.9	----	27	9,667	−34.2	----	23	9,361	−40.8	----	26	9,382	−38.5	----
250	29	10,654	−46.3	----	27	10,857	−44.1	----	30	10,491	−50.8	----	29	10,924	−44.3	----	27	10,917	−44.1	----	23	10,578	−49.4	----	24	10,626	−46.4	----
200	28	12,103	−55.1	----	26	12,318	−55.7	----	30	11,918	−57.9	----	28	12,377	−56.6	----	27	12,374	−55.6	----	21	12,000	−57.4	----	23	12,080	−55.6	----
175	26	12,946	−58.8	----	25	13,157	−62.0	----	29	12,751	−59.9	----	28	13,210	−63.5	----	27	13,212	−61.6	----	19	12,843	−59.3	----	22	12,918	−59.7	----
150	22	13,899	−62.2	----	23	14,096	−67.7	----	29	13,710	−61.4	----	27	14,137	−70.7	----	25	14,157	−67.3	----	18	13,794	−60.9	----	19	13,873	−62.6	----
125	15	15,034	−65.2	----	17	15,177	−72.2	----	24	14,840	−64.0	----	20	15,208	−75.7	----	21	15,246	−72.9	----	15	14,916	−61.9	----	16	14,982	−65.3	----
100					7	16,510	−74.9	----	18	16,223	−64.4	----	7	16,479	−80.3	----	9	16,659	−76.9	----	6	16,252	−62.6	----	10	16,336	−66.9	----
80									15	17,574	−63.5	----													5	17,647	−66.5	----
60									5	19,326	−62.4	----																

See footnotes at end of table.

TABLE 1.—*Mean dynamic height (geopotential) in units of 0.98 dynamic meter, temperature in degrees centigrade, and relative humidity in percent, for standard pressures, as obtained by radiosondes during November 1948*—Continued

Standard pressure surface (mb.)	New Orleans, La. (1,015.7 mb.)				North Platte, Nebr. (915.0 mb.)				Oakland, Calif. (1,019.8 mb.)				Oklahoma City, Okla. (967.4 mb.)				Omaha, Nebr. (975.4 mb.)				Phoenix, Ariz. (975.9 mb.)				Pittsburgh, Pa. (970.6 mb.)			
	Number of observations	Dynamic height	Temperature	Relative humidity	Number of observations	Dynamic height	Temperature	Relative humidity	Number of observations	Dynamic height	Temperature	Relative humidity	Number of observations	Dynamic height	Temperature	Relative humidity	Number of observations	Dynamic height	Temperature	Relative humidity	Number of observations	Dynamic height	Temperature	Relative humidity	Number of observations	Dynamic height	Temperature	Relative humidity
Surface	28	2	15.8	85	30	849	0.5	73	30	6	12.3	72	30	391	8.4	61	30	308	5.5	75	30	339	11.4	42	30	382	8.1	74
1,000	28	134	16.6	79	30	123	(*)	----	30	170	13.5	59	30	114	(*)	----	30	103	(*)	----	30	131	(*)	----	30	134	(*)	----
950	28	570	15.1	74	30	547	(*)	----	30	603	12.5	49	30	543	9.6	56	30	523	5.7	68	30	570	17.8	20	30	564	8.2	69
900	28	1,028	13.7	66	30	982	2.9	65	30	1,054	10.8	43	30	989	7.8	55	30	963	3.2	63	30	1,027	14.8	19	30	1,004	6.4	66
850	28	1,509	12.7	58	30	1,444	1.7	58	30	1,528	9.3	40	30	1,458	5.8	52	30	1,425	1.7	59	30	1,507	11.1	21	30	1,471	4.0	64
800	28	2,017	11.1	56	30	1,930	−1.0	56	30	2,029	7.5	34	30	1,953	4.1	49	30	1,912	−.5	56	30	2,009	7.9	22	30	1,963	2.5	52
750	28	2,552	9.3	47	30	2,447	−4.0	59	30	2,563	5.1	33	30	2,482	2.4	43	30	2,430	−3.2	58	30	2,547	4.5	24	30	2,488	.6	47
700	28	3,124	7.2	41	30	2,984	−6.8	58	30	3,118	2.0	30	30	3,031	−.3	41	30	2,969	−6.1	56	30	3,097	2.2	----	30	3,034	−1.5	47
650	28	3,727	4.0	----	30	3,565	−10.3	52	30	3,714	−1.4	30	30	3,624	−3.8	40	30	3,552	−9.0	53	30	3,697	−1.0	----	29	3,628	−4.2	47
600	28	4,377	−.2	----	30	4,172	−13.8	45	30	4,346	−4.1	30	30	4,248	−7.6	39	30	4,162	−11.8	45	30	4,325	−4.7	----	29	4,250	−7.5	47
550	28	5,067	−4.2	----	30	4,831	−18.2	47	30	5,027	−8.8	29	29	4,918	−11.9	32	30	4,823	−15.9	45	30	5,003	−9.4	----	29	4,926	−11.6	39
500	27	5,810	−8.9	----	30	5,533	−22.7	----	30	5,757	−13.5	30	29	5,639	−16.7	----	30	5,536	−20.8	----	30	5,732	−14.7	----	28	5,639	−15.8	38
450	27	6,625	−14.2	----	30	6,306	−28.0	----	29	6,552	−18.9	----	29	6,430	−22.2	----	30	6,313	−26.2	----	30	6,528	−20.5	----	26	6,440	−20.4	33
400	27	7,503	−20.4	----	29	7,128	−34.3	----	29	7,416	−25.3	----	29	7,280	−27.6	----	30	7,150	−31.8	----	30	7,382	−26.6	----	26	7,295	−25.9	----
350	27	8,479	−26.9	----	29	8,049	−40.6	----	29	8,371	−32.5	----	29	8,229	−33.3	----	30	8,080	−38.6	----	30	8,332	−33.4	----	25	8,247	−32.4	----
300	26	9,573	−34.9	----	28	9,090	−46.3	----	29	9,440	−40.3	----	29	9,298	−39.4	----	30	9,124	−44.8	----	30	9,399	−40.8	----	22	9,317	−39.5	----
250	26	10,819	−44.6	----	28	10,288	−51.1	----	28	10,662	−49.4	----	29	10,527	−46.3	----	30	10,328	−50.5	----	30	10,618	−48.7	----	19	10,537	−47.7	----
200	24	12,276	−55.8	----	23	11,735	−54.3	----	28	12,095	−57.5	----	27	11,993	−53.7	----	27	11,769	−53.4	----	30	12,062	−55.7	----	16	11,986	−55.0	----
175	22	13,116	−61.5	----	22	12,590	−54.4	----	28	12,931	−60.9	----	21	12,858	−56.8	----	23	12,604	−53.8	----	30	12,905	−59.2	----	13	12,829	−58.5	----
150	21	14,057	−66.1	----	15	13,552	−55.7	----	24	13,888	−63.7	----	19	13,827	−60.1	----	19	13,592	−56.0	----	28	13,860	−62.8	----	10	13,790	−61.6	----
125	15	15,151	−70.0	----	7	14,714	−61.1	----	19	14,998	−65.8	----	15	14,967	−63.8	----	10	14,774	−57.9	----	27	14,982	−66.2	----	6	14,904	−63.2	----
100	6	16,467	−72.6	----	5	16,064	−60.0	----	12	16,344	−67.0	----	12	16,341	−66.1	----	5	16,148	−60.2	----	14	16,284	−67.2	----	----	----	----	----

Standard pressure surface (mb.)	Portland, Maine (1,015.1 mb.)				Rapid City, S. Dak. (900.0 mb.)				St. Cloud, Minn. (972.9 mb.)				San Antonio, Tex. (988.8 mb.)				San Juan, P. R. (1,012.8 mb.)				Santa Maria, Calif. (1,010.1 mb.)				Sault Ste. Marie, Mich. (984.3 mb.)			
	Number of observations	Dynamic height	Temperature	Relative humidity	Number of observations	Dynamic height	Temperature	Relative humidity	Number of observations	Dynamic height	Temperature	Relative humidity	Number of observations	Dynamic height	Temperature	Relative humidity	Number of observations	Dynamic height	Temperature	Relative humidity	Number of observations	Dynamic height	Temperature	Relative humidity	Number of observations	Dynamic height	Temperature	Relative humidity
Surface	30	20	6.0	83	30	980	−0.4	73	30	317	0.0	86	30	240	13.3	68	30	15	25.3	84	30	71	11.4	65	30	221	3.2	90
1,000	30	142	6.7	73	30	123	(*)	----	30	95	(*)	----	30	126	(*)	----	30	127	24.9	83	30	155	12.9	61	30	91	(*)	----
950	30	566	5.1	68	30	544	(*)	----	30	517	.8	79	30	567	15.9	51	30	582	22.2	84	30	593	14.4	40	30	513	2.2	83
900	30	1,003	3.0	68	30	984	(*)	----	30	941	−.6	75	30	1,020	13.3	51	30	1,047	19.2	85	30	1,043	13.4	32	30	942	.0	81
850	30	1,464	1.0	67	30	1,440	.9	54	30	1,397	−1.9	67	30	1,498	11.1	46	30	1,537	16.4	82	30	1,522	11.2	31	30	1,399	−2.0	76
800	30	1,951	−.2	56	30	1,925	−2.0	52	30	1,878	−3.4	62	30	2,003	9.6	39	30	2,052	13.8	74	30	2,026	9.3	28	30	1,880	−4.0	73
750	30	2,473	−1.8	46	30	2,440	−5.0	54	30	2,392	−5.5	57	30	2,543	8.3	34	30	2,598	11.3	62	30	2,566	7.4	----	30	2,394	−6.0	68
700	30	3,013	−4.2	45	30	2,974	−8.1	52	30	2,925	−8.3	57	30	3,104	5.9	32	30	3,168	8.4	53	30	3,124	5.1	----	30	2,925	−8.4	64
650	29	3,603	−6.7	45	30	3,553	−11.5	50	30	3,500	−11.3	56	30	3,712	2.7	----	30	3,781	5.0	50	30	3,728	1.6	----	29	3,509	−11.3	63
600	29	4,219	−10.1	42	30	4,155	−15.1	48	30	4,107	−14.6	52	30	4,349	−1.4	----	30	4,427	1.4	48	30	4,365	−2.2	----	29	4,113	−14.0	57
550	29	4,888	−14.2	40	30	4,813	−18.8	46	30	4,761	−18.7	46	30	5,039	−5.4	----	30	5,124	−2.4	44	30	5,052	−6.4	----	29	4,773	−18.3	51
500	29	5,602	−18.6	37	30	5,513	−23.4	----	30	5,465	−23.3	----	30	5,779	−9.9	----	30	5,873	−6.9	37	30	5,788	−11.6	----	29	5,474	−22.7	----
450	29	6,388	−23.7	----	30	6,281	−28.8	----	30	6,233	−28.8	----	30	6,593	−15.2	----	30	6,696	−12.0	----	30	6,595	−17.5	----	28	6,251	−27.9	----
400	29	7,231	−29.6	----	30	7,108	−35.1	----	30	7,061	−34.6	----	30	7,464	−21.3	----	30	7,580	−18.2	----	30	7,459	−24.0	----	28	7,079	−33.8	----
350	29	8,172	−35.5	----	30	8,026	−41.7	----	29	7,978	−40.9	----	29	8,439	−28.2	----	30	8,562	−25.7	----	30	8,423	−31.1	----	27	8,003	−40.1	----
300	29	9,229	−42.6	----	30	9,056	−47.8	----	26	9,011	−46.6	----	28	9,524	−35.9	----	30	9,659	−34.2	----	30	9,494	−39.1	----	24	9,038	−46.2	----
250	29	10,438	−50.5	----	30	10,246	−51.5	----	21	10,245	−50.5	----	24	10,765	−44.5	----	30	10,909	−43.9	----	30	10,719	−48.1	----	22	10,235	−51.2	----
200	28	11,867	−56.8	----	26	11,689	−52.8	----	19	11,693	−52.7	----	20	12,229	−54.5	----	30	12,370	−55.2	----	30	12,158	−57.1	----	18	11,671	−54.0	----
175	27	12,709	−59.2	----	23	12,555	−53.0	----	18	12,557	−52.4	----	18	13,076	−59.4	----	28	13,210	−61.0	----	29	12,989	−60.7	----	12	12,532	−54.2	----
150	24	13,655	−60.1	----	18	13,549	−53.7	----	16	13,562	−53.7	----	13	14,053	−64.2	----	23	14,155	−66.8	----	25	13,944	−63.4	----	7	13,541	−55.0	----
125	16	14,768	−60.7	----	12	14,716	−54.7	----	14	14,734	−55.2	----	11	15,152	−69.1	----	20	15,244	−72.1	----	23	15,050	−66.4	----	5	14,679	−55.7	----
100	7	16,148	−60.7	----	5	16,125	−56.0	----	13	16,152	−56.3	----	----	----	----	----	5	16,566	−75.9	----	17	16,390	−68.8	----	----	----	----	----
80	6	17,529	−62.4	----	----	----	----	----	11	17,582	−57.3	----	----	----	----	----	----	----	----	----	12	17,716	−66.9	----	----	----	----	----

Standard pressure surface (mb.)	Spokane, Wash. (932.9 mb.)				Swan Island, W. I.[1] (000.0 mb.)				Tacubaya, Mex.[1] (0,000.0 mb.)				Tampa, Fla. (1,016.2 mb.)				Tatoosh Island, Wash. (1,013.8 mb.)				Toledo, Ohio (990.5 mb.)				Washington, D. C. (1,015.5 mb.)			
	Number of observations	Dynamic height	Temperature	Relative humidity	Number of observations	Dynamic height	Temperature	Relative humidity	Number of observations	Dynamic height	Temperature	Relative humidity	Number of observations	Dynamic height	Temperature	Relative humidity	Number of observations	Dynamic height	Temperature	Relative humidity	Number of observations	Dynamic height	Temperature	Relative humidity	Number of observations	Dynamic height	Temperature	Relative humidity
Surface	30	721	1.5	82	----	----	----	----	----	----	----	----	30	9	21.3	87	30	31	7.4	82	30	191	6.9	84	30	25	10.8	76
1,000	30	156	(*)	----	----	----	----	----	----	----	----	----	30	148	22.0	80	30	144	6.6	80	30	111	(*)	----	30	153	11.0	68
950	30	576	(*)	----	----	----	----	----	----	----	----	----	30	598	19.6	76	30	565	4.1	77	30	540	7.4	71	30	582	9.1	63
900	30	1,010	1.4	72	----	----	----	----	----	----	----	----	30	1,058	16.8	75	30	1,001	1.7	73	30	978	4.8	69	30	1,026	7.5	60
850	30	1,468	−.9	66	----	----	----	----	----	----	----	----	30	1,544	14.5	67	30	1,460	.0	64	30	1,443	2.5	63	30	1,496	5.7	55
800	30	1,950	−3.6	63	----	----	----	----	----	----	----	----	29	2,055	12.4	52	30	1,944	−2.5	59	30	1,931	.7	59	30	1,991	4.6	51
750	30	2,459	−6.3	65	----	----	----	----	----	----	----	----	29	2,598	10.0	46	30	2,458	−5.2	51	30	2,452	−1.6	58	30	2,521	3.0	49
700	30	2,994	−9.3	63	----	----	----	----	----	----	----	----	29	3,165	7.2	40	30	2,992	−8.2	43	30	2,995	−3.6	53	30	3,073	.8	48
650	30	3,567	−12.3	60	----	----	----	----	----	----	----	----	29	3,776	3.8	38	30	3,570	−11.7	41	29	3,588	−6.4	45	30	3,668	−2.3	46
600	30	4,172	−16.0	60	----	----	----	----	----	----	----	----	29	4,417	.2	31	29	4,175	−15.0	47	29	4,197	−9.5	43	30	4,297	−5.5	46
550	29	4,823	−20.3	58	----	----	----	----	----	----	----	----	29	5,111	−3.9	27	29	4,832	−18.4	48	29	4,867	−13.6	41	30	4,979	−9.3	42
500	29	5,522	−24.8	----	----	----	----	----	----	----	----	----	29	5,855	−8.3	----	29	5,534	−22.7	----	29	5,583	−18.3	39	30	5,705	−14.0	41
450	29	6,286	−29.6	----	----	----	----	----	----	----	----	----	29	6,674	−13.9	----	29	6,306	−27.5	----	28	6,366	−24.1	----	30	6,502	−19.2	37
400	29	7,113	−35.0	----	----	----	----	----	----	----	----	----	29	7,550	−19.8	----	28	7,136	−33.5	----	28	7,209	−29.8	----	30	7,364	−25.0	----
350	29	8,032	−41.2	----	----	----	----	----	----	----	----	----	28	8,527	−26.9	----	28	8,061	−39.4	----	27	8,148	−35.9	----	30	8,320	−32.1	----
300	29	9,065	−47.1	----	----	----	----	----	----	----	----	----	27	9,617	−35.5	----	26	9,068	−45.4	----	27	9,204	−42.6	----	30	9,390	−40.0	----
250	29	10,255	−51.9	----	----	----	----	----	----	----	----	----	25	10,862	−45.2	----	26	10,289	−50.5	----	26	10,416	−49.6	----	29	10,619	−48.8	----
200	29	11,691	−54.3	----	----	----	----	----	----	----	----	----	23	12,313	−56.7	----	26	11,732	−53.6	----	24	11,850	−55.4	----	25	12,046	−57.7	----
175	25	12,526	−53.5	----	----	----	----	----	----	----	----	----	23	13,148	−62.7	----	23	12,551	−52.8	----	24	12,696	−57.3	----	24	12,872	−61.2	----
150	23	13,524	−53.9	----	----	----	----	----	----	----	----	----	20	14,088	−68.1	----	21	13,542	−53.6	----	23	13,667	−58.8	----	21	13,824	−63.0	----
125	19	14,686	−55.6	----	----	----	----	----	----	----	----	----	16	15,160	−72.8	----	17	14,687	−53.9	----	16	14,792	−60.2	----	16	14,928	−65.1	----
100	15	16,101	−55.3	----	----	----	----	----	----	----	----	----	7	16,456	−76.8	----	12	16,107	−54.4	----	11	16,179	−61.6	----	9	16,298	−66.2	----
80	10	17,520	−55.4	----	----	----	----	----	----	----	----	----	----	----	----	----	9	17,540	−54.6	----	----	----	----	----	5	17,649	−64.7	----

[1] Data not yet received.
[2] Insufficient observations.
*Temperature and relative humidity data for this level are not available or are available only for certain days. See note entitled "Change in Summarization of Radiosonde Data," p. 6, in the January 1946 issue of the MONTHLY WEATHER REVIEW.

NOTE.—All observations scheduled between 0300 and 0500, G. C. T. except at Ciudad Victoria, Mazatlan, and Merida, where they are taken near 0200 G. C. T. "Number of observations" refers to those of dynamic height only. (In a few cases temperature or humidity data may be missing for one or more standard pressure surfaces of some observations.) Relative humidity data are not published for standard pressure surfaces having a corresponding mean temperature below −20°C.

All relative humidity observations are obtained by electric hygrometer and have been adjusted to compensate for the values occurring below the operating range of the humidity element. For explanation of the adjustment, see article entitled "Curve Method for Obtaining Monthly Means of Relative Humidity," p. 241, MONTHLY WEATHER REVIEW, December 1944.

None of the means included in these tables are based on less than 15 observations at the surface or 5 observations at a standard pressure level.

TABLE 2.—*Free-air resultant winds based on pilot balloon observations made near 2200 G. C. T., during November 1948. Directions given in degrees from north (N=360°, E=90°, S=180°, W=270°). Speeds in meters per second*

Altitude (meters) m. s. l.	Abilene, Tex. (534 m.)			Albuquerque, N. Mex. (1,627 m.)			Atlanta, Ga. (299 m.)			Billings, Mont. (1,095 m.)			Bismarck, N. Dak. (505 m.)			Boise, Idaho (868 m.)			Brownsville, Tex. (7 m.)			Buffalo, N. Y. (220 m.)			Burlington, Vt. (100 m.)			Charleston, S. C. (16 m.)			Cincinnati, Ohio (273 m.)			Denver, Colo. (1,618 m.)			El Paso, Tex. (1,198 m.)		
	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed
Surface	30	266	2.8	30	281	2.7	24	205	0.6	30	283	5.5	29	308	2.6	28	312	1.5	30	130	0.5	26	223	4.2	27	217	2.5	28	182	0.9	27	213	3.6	30	342	2.5	30	281	3.6
500							24	235	.5										30	297	.4	26	225	6.7	27	218	5.3	28	206	3.6	27	208	5.2						
1,000	30	258	5.2				23	239	1.4				29	295	5.2	28	310	1.9	26	298	2.9	24	231	9.3	25	231	6.6	27	226	5.8	24	220	6.7						
1,500	30	260	5.8				21	257	4.2	30	280	8.4	22	283	8.1	28	288	3.7	24	291	5.5	14	230	10.5	23	252	7.8	25	236	9.0	23	237	8.5				30	277	4.3
2,000	29	264	9.3	30	280	3.1	20	247	9.1	30	288	9.5	18	282	9.0	28	293	6.7	21	267	5.6	12	234	12.9	18	268	8.8	23	244	9.9	19	249	8.7	30	344	3.3	30	272	4.8
2,500	28	269	10.9	30	290	5.1	17	246	11.3	29	284	9.5	17	290	10.7	26	290	8.9	19	257	6.7				14	275	11.3	23	250	11.6	18	250	11.4	29	311	4.9	29	262	6.8
3,000	27	266	11.8	30	294	8.0	15	252	13.3	24	286	11.2	16	291	10.7	22	302	8.4	19	247	7.6				13	282	12.1	22	245	12.7	17	252	14.4	28	302	6.5	29	276	8.1
4,000	25	262	15.7	29	293	11.7	12	243	18.1	21	296	13.9	15	275	11.5	15	314	12.4	19	248	9.8				12	273	16.3	17	245	13.8	15	255	18.6	26	305	11.7	28	282	12.7
5,000	20	259	19.7	25	298	13.9	11	247	18.4	16	310	14.3	14	276	9.3	12	316	19.4	17	259	12.4				11	266	18.2	16	248	14.3	14	254	20.4	22	307	14.4	25	276	15.1
6,000	16	259	28.1	24	294	15.8	11	250	21.0	12	297	16.7	12	281	16.3	10	317	22.9	17	260	17.0				10	266	21.2	15	243	16.6	12	254	27.4	18	300	16.3	23	279	16.1
8,000				24	303	19.4													15	253	21.4													16	320	20.2	19	277	22.9
10,000				19	298	23.2																												14	307	21.2	13	269	25.9
12,000				15	280	28.1																															12	267	30.9

Altitude (meters) m. s. l.	Ely, Nev. (1,910 m.)			GrandJunction, Colo. (1,475 m.)			Greensboro, N. C. (271 m.)			Havre, Mont. (767 m.)			Jacksonville, Fla. (16 m.)			Joliet, Ill. (178 m.)			Las Vegas, Nev. (575 m.)			Little Rock, Ark. (88 m.)			Medford, Oreg. (416 m.)			Miami, Fla. (12 m.)			Mobile, Ala. (66 m.)			Nashville, Tenn. (182 m.)			New York, N. Y. (15 m.)		
	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed
Surface	30	310	2.5	30	322	1.6	21	269	0.3	27	270	4.0	29	124	1.0	24	240	3.3	30	27	1.7	27	220	1.3	30	276	1.0	30	116	3.9	25	164	0.7	27	187	2.0	27	249	1.3
500							21	249	.8				29	189	2.2	24	217	4.4				27	221	2.5	30	280	1.2	30	115	4.2	25	183	1.4	27	185	4.6	27	240	3.5
1,000							21	237	1.8	27	264	7.6	26	217	5.1	23	229	5.4	30	25	2.7	25	236	4.8	29	256	2.0	30	130	3.4	20	284	2.8	24	205	5.2	26	274	4.9
1,500				30	322	1.7	21	263	4.2	27	274	9.8	25	233	8.3	17	240	9.6	30	8	2.5	20	258	5.8	27	260	3.3	28	149	2.5	18	286	5.8	20	219	8.3	22	272	9.1
2,000	30	304	2.3	30	308	1.8	20	260	8.2	25	280	11.5	22	237	9.3	17	239	11.2	30	298	2.5	18	256	8.6	20	284	3.7	25	158	1.7	16	270	8.0	16	244	8.6	16	272	10.5
2,500	30	293	3.4	30	264	3.2	19	256	12.0	20	284	13.2	20	238	9.1	15	232	13.3	30	307	4.1	18	261	11.4	15	329	8.0	23	183	2.0	15	254	10.5	16	246	10.6	13	270	11.8
3,000	30	296	5.2	29	273	5.0	18	250	14.1	18	284	13.7	18	237	10.1	13	252	14.7	30	315	6.8	18	257	14.0	13	329	10.2	23	200	2.4	14	252	12.7	16	255	13.9	10	269	12.4
4,000	23	311	11.5	25	298	10.4	17	255	18.6	11	297	15.5	18	236	11.1	11	251	18.7	30	317	11.3	16	259	18.8	11	323	13.2	23	242	2.4	12	257	16.9	14	258	16.2			
5,000	22	308	16.2	20	304	12.4	14	257	18.1	10	305	18.0	17	238	13.5				29	312	14.5	15	263	21.9	10	320	15.0	22	245	3.7				12	262	20.5			
6,000	20	306	20.9	18	300	16.1	12	260	19.7				14	248	12.2				27	312	16.8	11	274	21.6				20	242	5.5				10	251	24.9			
8,000	11	304	19.2	12	293	22.8							10	260	14.7				22	297	20.9							18	247	6.6									
10,000																			14	306	23.3							11	258	10.4									
12,000																			10	317	24.4							10	275	12.2									

Altitude (meters) m. s. l.	Oakland, Calif. (8 m.)			Oklahoma City, Okla. (396 m.)			Omaha, Nebr. (306 m.)			Phoenix, Ariz. (338 m.)			Rapid City, S. Dak. (982 m.)			St. Cloud, Minn. (318 m.)			St. Louis, Mo. (181 m.)			San Antonio, Tex. (240 m.)			San Diego, Calif. (13 m.)			Sault Ste. Marie, Mich. (221 m.)			Seattle, Wash. (116 m.)			Spokane, Wash. (725 m.)			Washington, D. C. (24 m.)		
	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed
Surface	30	277	2.4	28	275	2.8	26	269	1.4	30	305	0.6	29	329	6.1	22	273	1.7	29	221	1.8	27	293	2.1	30	284	3.2	23	239	1.4	28	200	3.1	28	213	3.7	28	241	1.3
500	30	342	3.2	28	273	2.8	26	259	1.9	30	310	.8				22	287	2.0	29	230	3.7	27	298	1.8	30	315	3.1	23	222	2.2	28	207	6.2				28	220	3.1
1,000	28	353	5.4	28	268	3.4	25	261	3.5	30	346	1.0	29	328	6.2	19	294	3.4	26	241	5.2	27	291	2.2	29	352	2.2	14	243	4.7	24	218	6.9	28	217	6.4	24	239	5.4
1,500	28	348	6.7	24	249	4.7	23	263	6.3	30	360	1.1	29	321	8.1	16	287	5.1	21	242	8.0	26	284	3.9	29	9	3.0				17	239	6.1	27	240	8.3	23	249	8.1
2,000	27	346	8.5	22	255	8.7	19	266	7.3	30	330	2.6	28	315	8.4	15	299	6.1	20	243	10.4	25	283	6.3	29	1	3.9				10	272	5.9	24	250	8.8	21	257	10.5
2,500	27	337	9.7	22	263	10.6	19	275	9.6	30	328	4.7	26	311	8.6	14	302	7.1	17	255	11.8	24	273	8.5	29	348	5.9							19	265	8.5	18	260	15.3
3,000	27	334	10.4	20	268	12.1	17	277	10.9	29	309	5.7	25	301	10.0	13	305	6.1	17	251	14.1	24	263	10.5	29	336	7.1							19	278	9.7	18	255	17.0
4,000	23	334	11.7	20	271	15.7	14	275	14.6	27	314	10.6	20	293	12.2	10	294	5.8	16	255	18.1	22	259	14.5	28	329	9.5							14	294	12.2	15	259	19.3
5,000	22	322	13.7	20	266	18.9	10	280	19.9	26	307	14.3	17	299	15.2				13	264	20.9	22	258	18.2	27	315	10.8							12	308	16.9	14	263	22.5
6,000	21	323	14.9	20	258	22.6	10	287	24.2	25	307	16.6	12	307	19.0				10	264	25.5	21	255	20.3	26	318	14.0							11	313	19.2	11	266	25.5
8,000	13	323	16.6	10	253	34.6				18	306	17.9										12	251	24.4	19	321	15.3												
10,000										10	298	19.1													12	328	12.3												
12,000																									11	326	13.5												

TABLE 3.—*Free-air resultant winds based on rawin observations made near 0300 G. C. T., during November 1948. Directions given in degrees from north (N=360°, E=90°, S=180°, W=270°). Speeds in meters per second*

Altitude (meters) m. s. l.	Albuquerque, N. Mex. (1,636 m.)			Big Spring, Tex. (774 m.)			Bismarck, N. Dak. (505 m.)			Brownsville, Tex. (7 m.)			Caribou, Maine (191 m.)			Charleston, S. C. (13 m.)			Columbia, Mo. (237 m.)			Grand Junction, Colo. (1,473 m.)			Greensboro, N. C. (275 m.)			Hatteras, N. C. (3 m.)			International Falls, Minn. (358 m.)			Little Rock, Ark. (80 m.)			Miami, Fla. (12 m.)		
	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed
Surface	30	359	1.4	30	190	1.5	30	312	1.6	30	158	0.7	30	250	1.7	30	126	0.2	30	177	2.6	30	10	0.6	29	65	0.4	30	90	0.5	30	306	0.6	30	222	1.0	30	85	1.9
500										30	147	1.6	30	262	4.3	30	194	4.2	30	208	5.1				28	203	.8	29	190	2.6	30	283	1.0	30	216	4.2	29	116	5.2
1,000				30	243	4.0	30	306	6.8	30	143	1.2	30	266	6.4	28	216	6.1	30	239	6.3				29	206	4.4	29	221	4.8	30	272	2.6	30	229	5.2	29	120	4.6
1,500				30	271	7.5	29	309	7.5	30	247	1.5	29	277	7.6	28	224	8.6	30	254	8.0	30	8	.6	29	227	7.7	28	240	6.6	30	279	4.3	30	234	7.0	29	121	3.6
2,000	30	311	4.9	30	281	9.6	29	307	8.5	30	253	3.4	28	273	8.6	28	230	9.7	30	255	9.1	30	335	.9	27	244	9.6	28	244	7.9	29	278	5.0	30	243	8.6	29	136	2.6
2,500	30	303	7.2	30	277	9.7	29	309	9.8	30	243	5.8	28	268	10.1	27	238	10.1	30	262	9.9	30	268	2.2	26	250	12.7	26	255	9.6	28	268	5.8	29	248	10.6	29	156	2.3
3,000	30	298	9.5	29	266	10.8	29	305	10.5	30	244	7.7	28	266	11.8	28	238	9.8	30	261	11.7	30	283	4.6	26	249	13.9	26	256	11.3	28	274	7.2	28	252	12.4	30	170	1.5
4,000	30	299	11.1	28	266	13.3	29	296	11.5	29	244	10.1	28	266	13.6	25	243	10.7	29	259	15.0	30	302	9.1	23	245	15.3	27	259	13.1	30	266	9.1	28	240	16.6	30	233	1.7
5,000	29	300	14.8	27	271	15.7	27	295	8.5	28	251	11.5	26	269	16.7	24	247	12.5	28	255	17.8	30	304	12.5	23	247	17.5	25	261	14.2	30	269	7.8	28	237	20.8	30	262	2.8
6,000	29	296	15.6	25	269	18.1	26	292	12.3	28	243	13.5	23	272	19.5	23	252	14.8	28	253	20.5	28	305	14.1	22	250	21.8	24	263	16.3	28	264	10.9	23	246	19.5	28	246	4.2
8,000	16	280	15.9	16	258	20.9	26	283	14.5	27	248	18.3	16	269	16.2	19	256	17.5	23	250	24.3	21	290	15.6	18	260	21.2	17	274	16.1	26	255	11.2	14	247	26.4	27	274	7.3
10,000	10	290	18.1				19	253	14.5	26	250	24.3	12	259	23.8	13	278	20.6	13	253	23.4	16	315	18.5	14	261	23.6	13	285	21.2	25	255	16.3				26	293	10.1
12,000							13	260	14.0	16	255	25.2										11	311	15.0				12	295	24.8	24	251	16.0				26	296	11.7
14,000							12	273	13.3																						21	263	13.8				24	296	12.2
16,000																															14	245	12.7				11	262	8.7

Altitude (meters) m. s. l.	Nantucket, Mass. (14 m.)			Nashville, Tenn. (180 m.)			New Orleans, La. (6 m.)			Oakland, Calif. (8 m.)			Oklahoma City, Okla. (392 m.)			Rapid City, S. Dak. (980 m.)			San Antonio, Tex. (242 m.)			San Juan, P. R. (28 m.)			St. Cloud, Minn. (318 m.)			Santa Maria, Calif. (72 m.)			Sault Ste. Marie, Mich. (221 m.)			Spokane, Wash. (726 m.)			Tatoosh Island, Wash. (33 m.)		
	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed
Surface	28	270	0.1	30	181	1.3	29	149	0.6	30	290	1.0	29	250	1.2	29	304	4.0	30	10	1.0	30	109	2.9	30	285	0.9	30	5	2.2	30	140	1.6	28	198	2.9	29	209	2.5
500	28	252	3.3	30	198	4.8	27	198	1.6	29	324	3.5	26	265	1.7				30	176	.4	30	95	6.6	27	299	.8	29	13	5.0	30	108	2.8				29	229	4.5
1,000	28	250	4.2	30	214	6.5	28	248	2.0	29	344	4.4	25	252	3.5	29	305	4.4	30	230	1.9	30	100	7.3	27	287	2.5	29	16	5.7	29	213	4.9	28	218	5.7	28	263	5.7
1,500	28	255	6.6	27	239	6.8	26	251	5.1	29	344	5.2	27	256	6.1	29	318	8.3	30	262	3.2	30	99	7.0	27	287	3.8	29	6	6.1	28	233	7.2	27	243	7.1	28	273	7.4
2,000	28	256	8.6	27	243	8.7	26	247	6.9	30	343	6.7	27	263	7.9	29	320	10.2	30	262	6.0	30	95	6.5	26	282	4.6	29	348	7.9	27	249	8.8	26	259	7.2	28	272	8.5
2,500	26	261	10.2	27	240	11.4	26	244	11.0	30	333	8.4	27	264	9.2	29	319	10.5	30	260	7.8	30	93	6.1	26	286	5.7	29	338	9.5	24	254	8.6	24	285	7.8	27	283	9.7
3,000	25	259	13.4	27	241	13.9	26	243	12.2	30	328	10.2	27	262	10.6	29	312	10.9	30	255	9.6	30	93	5.8	26	286	7.0	29	338	10.7	24	253	10.1	23	263	8.7	26	286	11.5
4,000	24	262	14.6	25	250	16.8	25	247	14.0	30	319	13.8	27	263	14.3	28	306	11.8	30	251	12.9	30	84	4.2	28	275	8.2	28	330	12.4	20	259	12.4	23	288	12.2	23	297	14.5
5,000	22	260	19.1	23	247	19.6	23	257	14.2	30	311	16.4	27	262	17.7	28	307	12.8	30	251	16.1	30	88	3.5	28	267	7.4	27	319	12.5	20	257	9.3	22	297	13.3	19	297	17.4
6,000	19	263	18.1	19	249	23.6	22	254	17.7	27	312	18.8	26	258	20.2	27	297	13.8	27	254	18.2	30	75	2.5	27	258	12.2	25	316	12.6	18	273	12.6	19	288	14.2	15	292	17.7
8,000	12	265	21.4	14	254	32.0	20	249	24.2	21	305	18.6	20	250	25.3	24	288	15.7	19	254	19.9	30	97	.7	23	261	15.6	22	315	13.2	15	263	18.5	14	304	23.4			
10,000							15	258	28.6	13	312	17.8	15	250	34.1	20	281	17.9	10	247	24.6	30	254	3.6	14	239	15.7	18	309	13.4									
12,000							12	257	32.0	12	306	20.3				17	275	19.5				30	272	7.9	11	252	17.7	14	305	12.5									
14,000																						23	284	8.5				10	276	16.2									

NOTE.—Resultants prepared from rawins at high altitudes are biased toward lower wind speeds. Values appearing in this table should therefore be used with caution when the number of observations missing is greater than three. See note following Table 3 in the June 1948 issue of the MONTHLY WEATHER REVIEW.

RIVER STAGES AND FLOODS FOR NOVEMBER 1948

ELMER R. NELSON

River stages during November were above normal for the fifth consecutive month in the Missouri basin and in portions of the Ohio River Basin in Ohio and Tennessee. It was also above normal along the Atlantic and East Gulf of Mexico Drainage Areas from Pennsylvania to Mississippi. River stages were below normal in the New England States, except Maine, for the fifth consecutive month. Heavy rainfall brought ground water and river levels back to normal in Maine for the first time in over a year.

Severe flooding with record to near record stages developed in several streams in Georgia and Alabama towards the close of the month. Flash floods forced several families to leave their homes along the Peachtree and Nancy Creeks in Georgia and along the South Chickamauga Creek near Chattanooga, Tenn. Severe flooding occurred on First Creek at Knoxville, Tenn. The rivers in South Carolina reached their highest levels in three years. Moderate flood stages were reached along the James in Virginia. Light to moderate overflow occurred in most streams in Mississippi and North Carolina with some severe flooding in portions of Mississippi. Light flooding occurred in streams in Indiana, Louisiana, and Washington, and light to moderate flooding in Florida.

Precipitation during the month was above normal east of the Mississippi River except in Florida and the central portion of Illinois. It was above normal in the States immediately to the west of the Mississippi and along an irregular belt extending through the state of Washington. The greatest precipitation (4 to 6 times normal) occurred over northern Georgia, Alabama, and central Mississippi. The first snow of the season, other than in the higher elevations, occurred in Wyoming during the second week of October and during the third week in Pennsylvania and up-state New York. Some light snow fell as far south as northern New Mexico during the beginning of November. Arkansas, Missouri, and West Virginia reported their first snow on November 10. Heavy snow fell from western Kansas to the northern Lake region from the 18th to the 20th. Snow depths ranged from several inches in western Kansas to about a foot in eastern South Dakota, much of Minnesota and northern Wisconsin. Several inches fell during the same period in eastern Washington, and in the Central and Northern Rockies. Only a light snow cover, except in the mountains, remained on the ground by the end of November.

Atlantic Slope drainage.—Heavy rains (1.5 to 2 inches) over the James River Basin in Virginia on the 28th–29th caused crests 1.9 to 4.2 feet above bank-full stage below Bremo Bluff. Flood damage was negligible.

Only light local flooding resulted from the heavy rains over eastern North Carolina during the night of November 3d and early morning of the 4th. The rainfall averaged nearly 2 inches over the upper branches of the Cape Fear and Tar Rivers and almost 4 inches over the upper tributaries of the Neuse, but very little run-off occurred as the initial ground water stages were very low. The only above bank-full stages that occurred was on the Cape Fear at Elizabethtown and on the Neuse at Smithfield. General flooding developed on all the rivers in eastern North Carolina during the latter part of November and the beginning of December from the heavy rains on the 28th–29th. Favorable conditions, for high run-off, existed prior to this storm as occasional heavy rains during the interim period had maintained high initial ground water stages.

Most of the streams in South Carolina reached their highest levels in 3 years from the heavy rains during the 24-hour period ending at 8 a. m. on the 29th. Conditions were favorable for high run-off as the soil was saturated prior to this storm from the moderate rains that fell during an earlier rainy period of one week or more. All the rivers rose rapidly to above flood stage except the Waccamaw. Considerable damage resulted to lowland crops, highways, bridges, and some to railroad property.

A major freshet, with considerable damage, occurred in the Savannah River drainage basin at and above Butler Creek, Ga., during the last few days of the month and the first part of December. The rainfall, above Augusta, Ga., averaged 1.75 inches on the 27th, 1.25 inches on the 28th and 1.60 inches on the 29th. Several houses were washed off their foundations.

The Ocmulgee River, at Macon, Ga,. topped the previous highest stage of 26.1 feet of March 22, 1942, by 1.9 feet. It crested within 2 days after reaching flood stage on the 27th. Such severe flooding is unusual in the normally dry month of November. This year it was unusually wet, especially after the 19th, with no less than 7 days of heavy to excessive rain. The first important rain occurred on the 19th–20th with 1 to 3 inches of rain falling over the extreme upper reaches of the Ocmulgee. Two to four inches of additional rain fell over the upper half of the basin during the period 22d–24th. The most important rains occurred on the 27th when upper and middle stream stations reported 3 inches or more. Additional heavy rain occurred on the two following days. Much of Macon, nearest to the river, was inundated forcing many families to leave their homes. Damage to streets, roads, bridges, building foundations, equipment and furnishings of homes and stores was considerable. Flash floods occurred in the Atlanta area on the Peachtree and Nancy Creeks from the excessive rains on the 27th, flooding a large number of homes and other buildings. Twenty-five families were forced to leave their homes and others had to be evacuated by boat. Considerable damage was done to building foundations, furnishings, lawns, streets, and roads. One radio transmitting station was put out of service.

East Gulf of Mexico drainage.—The Chattahoochee River rose to several feet above bank-full stage from Norcross, Ga., to Columbia, Ala., during the latter part of November. This flooding was due to recurrent heavy to excessive rains during the last decade of the month. One to 3 inches of rain fell over the entire length of the river on the 19th–20th. Two to four inches of additional rain fell from the 22d–24th with the heaviest falls between West Point and Athens, Ga. Five to seven inches occurred between West Point and Griffin, Ga., on the 27th with additional heavy rains on the 28th–29th. The river at West Point rose into yards and stores in some sections causing damages to furnishings.

The Flint River rose rapidly after the heavy rains on the 27th inundating several acres of farm land and damaging roads and bridges. At Montezuma, Ga., the river rose to a depth of 4 feet in some streets.

Heavy to excessive rains during the period from the 16th–28th caused moderate flooding in the Conecuh River in Alabama and slight flooding in the lower Choctawhatchee in Florida. The rainfall averaged almost 11 inches during this period. Most of the damage along the Conecuh River was to crops, livestock, highways, and bridges. Only minor damage occurred along the Choctawhatchee.

The heavy rains of the 26th–27th brought one of the few large November rises in the history of both the Warrior and Tombigbee Rivers. The rains averaged 5.5 inches

over the Warrior Basin, 6.7 inches from Demopolis to Jackson, Ala., and 4 inches over the Upper Tombigbee area. The initial ground water stages were high due to the recurrent, unseasonably heavy rains during the decade preceding this rain.

The second highest November crest of record (63.5 feet) was reached on the Warrior at Tuscaloosa, Ala., at 6 a. m. on the 29th. It rose 32 feet in 48 hours and 18 feet during the last 24 hours.

The highest crest of record for this time of year (37.4 feet) was recorded on the Upper Tombigbee at Aberdeen, Miss., on December 1 (previous highest stage was 36.9 feet in 1925). The crest at Demopolis, Ala. (59.1 feet), was the highest since December 1932 (62.7 feet), and the second highest December crest of record. The crest passage was slowed up at Lock No. 1 (Jackson, Ala.) by the unusually high water in the Alabama River. When both rivers are high at the same time they merge at a considerable distance north of where they usually join to form the Mobile River. The water from the Alabama backed up or held up the water from the Tombigbee, and as a result the flow of the Tombigbee was not only held up at Lock No. 1, but the bayous and creeks 15 to 20 miles north of Mobile were from 4 to 6 feet above normal levels until the 4th week in December.

The second highest stage of record (26 feet) was reached on the Pearl River at Edinburg, Miss., on December 1 (previous highest crest, 26.2 feet, March 8, 1935). Heavy to severe flooding was in progress along the Pearl as far as Pearl River, La., by the end of the month. Record to near record stages were occurring along the Leaf River in Mississippi and moderate to heavy flooding along the Chickasawhay.

Upper Mississippi Basin—For the second consecutive month, stream flow was unusually low in the extreme upper Mississippi, Chippewa, and Wisconsin Rivers and the water in the reservoirs was reduced to such low levels that hydroelectric power was cut down. Even though precipitation was near normal during the month it did not increase the stream flow appreciably.

Thin ice formed on the pools in the Mississippi during the last decade.

Ohio Basin—Slight flooding occurred along the West Fork of the White River at Edwardsport, Ind., from the 7th to the 9th due to the heavy rains on the 5th and 6th.

Heavy rains (2.5 inches) over the French Broad River in western North Carolina on the 28th–29th resulted in slightly above bank-full stages at Asheville and Hot Springs. November 1948, was the wettest November on record (7.15 inches) at Asheville. The previous record was 4.85 inches in 1938. The discharge of the French Broad at Asheville was the greatest for November in a period of 50 years.

The storm of the 27th–29th, over the Tennessee River Basin climaxed a month of frequent heavy rain and established a new record of rainfall over the basin for November. Ground conditions were ideal for high run-off as this storm followed within 12 hours a general rain (0.8 inch) over the basin. Some very high flows resulted.

The average rainfall over the entire drainage area of 40,000 square miles was 2.92 inches. Approximately 2.75 inches fell over the lower half of the basin and 3.25 inches over the upper half. The main river drainage area between Chattanooga and Knoxville received the greatest concentration of rain with a general average over this portion of about 4.25 inches. The highest amount recorded during this storm was 6.05 inches at Twenty-Mile, in the mountains of western North Carolina.

The stages on the main river were held below flood level at critical points through the regulation and control activities of the Tennessee Valley Authority. Some agricultural lowlands immediately below some of the downstream dams were flooded. Along the main river at Chattanooga the highest point reached was 28.9 feet (30 feet flood stage).

Several unregulated creeks rose to flood stage and above for a short period. Most damaging of these were South Chickamauga Creek near Chattanooga, Tenn., and First Creek in Knoxville, Tenn. South Chickamauga Creek reached a record stage of 19.8 feet. It rose so rapidly that many houses were flooded and people and livestock had to be evacuated. Brainerd Hills and East Brainerd, two new subdivisions along the Chickamauga Creek are subject to flooding at a stage of 18.5 feet. Some damage resulted to basements, yards, shrubbery, and roads in these subdivisions.

Lower Mississippi Basin.—Rainfall averaged over 14 inches over the Yazoo Basin during the month. This was the greatest recorded rainfall in the basin in over 50 years. Nearly half of the rain fell during the storm of the 18th–19th with most of it falling during a 24-hour period. Rains ranged from 5 to 8 inches with the heaviest rains falling over the central Yalobusha Basin. Rivers rose rapidly as a result of this excessive fall, and considerable farm and woodland was overflowed with considerable damage. The Tallahatchie River crested at Swan Lake, Miss., 2.6 feet above bank-full stage on December 1. The Mississippi River remained well below flood stage throughout the month.

In the Atchafalaya Basin strong on-shore winds and the accompanying high tide caused the lower Atchafalaya River to rise above bank-full stage at Morgan City, La., for several hours during the night of the 18th–19th. No damage was reported.

West Gulf of Mexico drainage.—Scattered heavy rains over the Calcasieu River Basin during the last half of the month caused the Calcasieu to rise to 2.3 feet above flood stage at Kinder, La., by the 30th. It was still rising at the end of the month.

Pacific Slope drainage.—Two small freshets occurred in the Columbia Basin during November.

Heavy rains during the 24-hour period ending during the morning of the 24th caused moderate flooding in the Snohomish River at Snohomish, Wash., and the Snoqualmie River at Tolt, Wash., with light flooding in the Skykomish River at Gold Bar, Wash.

FLOOD STAGE REPORT FOR NOVEMBER

[All dates in May unless otherwise specified]

River and station	Flood stage	Above flood stages—dates		Crest [1]	
		From—	To—	Stage	Date
ATLANTIC SLOPE DRAINAGE					
James:	*Feet*				
Bremo Bluff, Va.	19	29	30	20.9	30
Columbia, Va.	18	29	30	22.2	30
State Farm, Va.	12	30	Dec. 1	15.5	30
Richmond, Va.	8	30	Dec. 1	10.0	30–Dec. 1
Roanoke:					
Alta Vista, Va.	10	29	(2)	23.0	29
Randolph, Va.	21	29	(2)	24.0	29
Weldon, N. C.	31	30	(2)		
Scotland Neck, N. C.	28	30	(2)		
Williamston, N. C.	10	27	(2)		
Tar: Rocky Mount, N. C.	9	30	(2)		
Neuse:					
Neuse, N. C.	14	29	(2)		
Smithfield, N. C.	13	5 29	7 (2)	15.5	6
Goldsboro, N. C.	14	29	(2)		
Kinston, N. C.	14	30	(2)		
Cape Fear:					
Moncure, N. C.	20	29	29	23.1	29
Fayetteville, N. C.	35	30	(2)	44.3	30
Lock No. 2, Elizabethtown, N. C.	20	6 26 29	6 26 (2)	21.4 20.8	6 26
Lynches: Effingham, S. C.	14	30	Dec. 7	15.9	Dec. 5
Pee Dee:					
Cheraw, S. C.	30	29	Dec. 2	37.0	30
Pee Dee, S. C.	19	26	(2)	24.2	Dec. 5
Black: Kingstree, S. C.	12	30	Dec. 5	12.5	Dec. 3
Saluda:					
Pelzer, S. C.	6	27	(2)	12.3	29
Chappells, S. C.	13	29	Dec. 2	24.6	29
Broad:					
Gaffney, S. C.	10	29	29	12.4	29
Blairs, S. C.	14	28	Dec. 2	29.0	30
Congaree: Columbia, S. C.	19	29	Dec. 1	25.6	30
Catawba:					
Catawba, N. C.	8	29	30	10.5	29
Catawba, S. C.	11	29	30	19.0	29
Wateree: Camden, S. C.	23	29	Dec. 2	31.4	30
Broad: Carlton, Ga.	15	27	30	23.6	29
Edisto:					
Orangeburg, S. C.	8	23	Dec. 6	9.6	30
Givhans Ferry, S. C.	10	29	(2)	14.6	Dec. 3
Savannah:					
Calhoun Falls, S. C.	8	29	29	8.5	29
Augusta, Ga.	32	29	(2)	36.2	30
Butler Creek, Ga.	21	28	(2)	26.4	30
Ogeechee: Midville, Ga.	6	30	(2)		
Ocmulgee: Macon, Ga.	18	27	30	28.0	28–29
Oconee: Milledgeville, Ga.	20	27	30	38.5	29
EAST GULF OF MEXICO DRAINAGE					
Chattahoochee:					
Norcross, Ga.	16	29	30	19.6	30
West Point, Ga.	19	27	30	22.4	29
Columbus, Ga.	34	27	30	42.0	28
Eufaula, Ala.	40	28	30	55.1	30
Columbia, Ala.	42	29	30	48.5	30
Flint: Montezuma, Ga.	20	30	30	24.4	30
Apalachicola: Blountstown, Fla.	15	15	23	20.6	30
Choctawhatchee: Caryville, Fla.	12	24	Dec. 6	13.2	Dec. 2
Conecuh:					
River Falls, Ala.	35	27	Dec. 1	41.6	30
Brewton, Ala.	17	28	Dec. 5	21.2	Dec. 2
Oostanaula:					
Resaca, Ga.	22	29	Dec. 3	31.4	30
Rome, Ga.	25	28	Dec. 5	31.9	30
Etowah:					
Canton, Ga.	17	29	30	22.0	29
Cartersville, Ga.	24	29	30	30.0	29
Coosa:					
Gadsden, Ala.	22	28	Dec. 10	28.8	Dec. 4–5
Childersburg, Ala.	25	29	Dec. 1	28.3	30
Wetumpka, Ala.	45	28	Dec. 4	54.6	29
Tallapoosa: Milstead, Ala.	40	27	30	49.0	28
Cahaba: Centerville, Ala.	23	28	30	33.6	28

FLOOD STAGE REPORT FOR NOVEMBER 1948—Con.

River and station	Flood stage	Above flood stages—dates		Crest	
		From—	To—	Stage	Date
Alabama:					
Montgomery, Ala.	45	28	Dec. 6	56.0	30–Dec. 1
Selma, Ala.	47	28	Dec. 9	56.3	Dec. 3
Millers Ferry, Ala.	48	27	Dec. 13	56.3	Dec. 10
Black Warrior:					
Tuscaloosa Lock and Dam, Ala.	47	28	Dec. 2	63.5	29
Lock No. 7, Eutaw, Ala.	35	29	Dec. 11	52.8	Dec. 3
Tombigbee:					
Aberdeen, Miss.	34	22 29	24 Dec. 4	34.6 37.4	23 Dec. 1
Gainesville, Ala.	36	28	Dec. 12	45.4	Dec. 6
Lock No. 4, Demopolis, Ala.	39	23	Dec. 15	59.1	Dec. 6–7
Lock No. 3.	33	21	(2)	58.2	Dec. 8
Lock No. 2.	46	27	Dec. 18	59.6	Dec. 9
Lock No. 1.	31	24	(2)	40.1	Dec. 12–13
Leaf:					
Hattiesburg, Miss.	22.5	28	Dec. 2	24.1	29
Beaumont, Miss.	20	23 26	25 Dec. 6	26.3	Dec. 1
Chickasawhay:					
Enterprise, Miss.	20	27	Dec. 2	32.5	30
Shubuta, Miss.	30	28	Dec. 6	38.7	Dec. 3
Waynesboro, Miss.	35	Dec. 3	Dec. 5	37.9	Dec. 4
Pascagoula: Merrill, Miss.	22	25	(2)	25.7	28
Bogue Chitto: Franklinton, La.	11	22 26 28	22 28 (2)	12.9	27
Pearl:					
Edinburg, Miss.	20	27	(2)	26.0	Dec. 1
Jackson, Miss.	18	20	(2)	32.9	Dec. 6
Monticello, Miss.	15	26	(2)	22.9	Dec. 2
Columbia, Miss.	17	27	(2)	21.2	Dec. 3
Bogalusa, La.	15	21	(2)		
Pearl River, La.	12	24	(2)	16.7	30
MISSISSIPPI SYSTEM					
Ohio Basin					
White: Edwardsport, Ind.	12	7	9	12.7	8
French Broad:					
Asheville, N. C.	6	28	Dec. 1	8.3	28
Hot Springs, N. C.	8	28	30	9.8	28
First Creek: Knoxville, Tenn.	5	28	29	7.2	28
South Chickamauga Creek: Chickamauga, Tenn.	10	28	Dec. 1	19.8	29
Sequatchee: Whitwell, Tenn.	12	28	Dec. 2	15.7	29
Elk: Prospect, Tenn.	21	28	Dec. 1	26.7	30
Shoal Creek: Iron City, Tenn.	9	28	29	13.7	28
Bear Creek: Bishop, Ala.	11	18	Dec. 2	16.1	29
Duck: Hurricane Mills, Tenn.	17	30	Dec. 2	18.1	Dec. 1
Tennessee:					
Paducah (nr), Ky.	34	Dec. 1	Dec. 9	39.3	Dec. 5
Florence, Ala.	18	28	Dec. 4	22.6	29
Savannah, Tenn.	39	Dec. 1	Dec. 5	41.0	Dec. 4
Lower Mississippi Basin					
Tallahatchie: Swan Lake, Miss.	26	23	(2)		
Atchafalaya Basin					
Atchafalaya: Morgan City, La.	6	18	19	6.4	18
WEST GULF OF MEXICO DRAINAGE					
Calcasieu: Kinder, La.	16	29	Dec. 3	18.7	30
PACIFIC SLOPE DRAINAGE					
Puget Sound					
Snoqualmie: Tolt, Wash.	50	24	25	53.0	24
Skykomish: Gold Bar, Wash.	10	24	24	10.1	24
Snohomish: Snohomish, Wash.	20	24	26	24.7	24

[1] Provisional.
[2] Continued at end of month.

CLIMATOLOGICAL DATA FOR NOVEMBER 1948

CONDENSED CLIMATOLOGICAL SUMMARY OF TEMPERATURE AND PRECIPITATION BY SECTIONS

[For description of tables and charts, see REVIEW, January 1948, p. 15]

In the following table are given for the various sections of the climatological service of the Weather Bureau the monthly average temperature and total rainfall; the stations reporting the highest and lowest temperatures, with dates of occurrence; the stations reporting the greatest and least total precipitation; and other data as indicated by the several headings.

The mean temperature for each section, the highest and lowest temperatures, the average precipitation, and the greatest and least monthly amounts are found by using all trustworthy records available.

The mean departures from normal temperatures and precipitation are based only on records from stations that have 10 or more years of observations. Of course, the number of such records is smaller than the total number of stations.

Section	Temperature								Precipitation					
			Monthly extremes								Greatest monthly		Least monthly	
	Section average	Departure from the normal	Station	Highest	Date	Station	Lowest	Date	Section average	Departure from the normal	Station	Amount	Station	Amount
	°F.	°F.		°F.			°F.		In.	In.		In.		In.
Alabama	56.8	+2.3	Eufaula	87	6	Valley Head	24	12	15.30	+11.81	Fort Deposit	24.58	Columbia	6.05
Arizona	46.5	−3.5	Mohawk	89	16	Alpine	−3	28	.02	−.95	Greer	.61	111 stations	.00
Arkansas	50.9	−.4	Portland	85	5	Lead Hill	13	23	5.78	+1.90	Hampton	12.72	Camp Chaffee	1.02
California	49.9	−2.1	3 stations	92	1 6	Boca	−1	27	1.08	−.96	Elk Valley	12.14	209 stations	.00
Colorado	30.1	−4.1	Las Animas	83	15	2 stations	−25	28	.77	−.02	La Veta Pass	4.63	5 stations	T
Florida	71.2	+6.0	Sarasota	93	22	do	32	11	2.56	+.35	Milton Exp. Station	13.67	Lake Trafford	T
Georgia	59.2	+4.5	Camilla	90	4	Blairsville Exp. Sta	24	1 11	9.57	+6.78	Flat Top	20.94	Brunswick	1.26
Idaho	32.3	−2.9	Riggins R. S	70	14	Island Park Dam	−23	27	2.41	+.31	Roland (West Portal)	9.57	Grand View	.16
Illinois	45.1	+3.0	Mt. Carmel	79	1 4	Freeport	14	29	3.44	+.80	Harrisburg	8.40	Bentley	1.07
Indiana	46.3	+3.9	W. Baden Springs Col	81	4	2 stations	18	24	5.20	+2.16	Leavenworth Dam #44	11.81	South Bend, W.B.Apt	2.27
Iowa	39.0	+1.4	Grinnell	76	15	Onawa	−4	22	2.66	+.93	Council Bluffs, 5 NE	5.69	Mt. Ayr	1.07
Kansas	42.5	−.7	Coffeyville	82	4	Healy	6	28	2.14	+.87	Winfield	4.89	Tribune	.59
Kentucky	49.7	+3.2	Pikesville	87	5	Beaver Dam	18	24	7.71	+4.25	Mammoth Cave Park	11.41	Greenup Dam #30	4.18
Louisiana	59.4	+.5	De Ridder	90	1	2 stations	24	1 12	12.08	+7.91	Winnsboro	23.37	Lake Arthur	3.48
Maryland-Delaware	50.6	+5.3	4 stations	82	6	Oakland (Md.)	20	26	5.68	+3.05	Cambridge (Md.)	9.38	Savage River Dam (Md.)	3.00
Michigan	41.2	+4.9	2 stations	70	1	2 stations	10	29	3.76	+1.23	Munising	6.91	Dowagiac, 2 E	1.65
Minnesota	31.6	+2.1	do	72	1	Warroad	−4	28	1.66	+.48	Comfrey	3.40	Orionville Sewage Plant	.26
Mississippi	56.6	+1.4	Leakesville	89	5	Port Gibson	24	30	13.80	+9.89	Wiggins	20.01	Magnolia	8.13
Missouri	46.3	+1.9	Caruthersville	87	4	Monett	10	29	3.50	+.79	Cape Girardeau	8.18	Albany	.70
Montana	31.7	−.2	Billings	70	14	West Yellowstone	−21	26	1.04	.00	Heron, 2 SW	7.28	Cut Bank, CAA Apt	.04
Nebraska	36.5	−.8	2 stations	79	15	2 stations	0	22	1.74	+.79	Falls City	4.27	Arthur	.16
Nevada	37.4	−1.8	Las Vegas	81	1 3	do	−5	1 8	.32	−.38	Jarbidge	3.08	23 stations	.00
New England	44.0	+5.8	Billerica, Mass	79	6	Fabyan, N. H	10	30	5.85	+2.25	Woodstock, N. H	8.54	Knightville Dam, Mass.	3.65
New Jersey	49.8	+5.9	Little Falls Water	83	7	Layton	17	30	4.66	+1.40	Atlantic City	8.87	Lakehurst	1.22
New Mexico	38.9	−3.4	Hagerman	85	3	Eagle Nest	−15	9	.21	−.42	Grenville	2.33	51 stations	.00
New York	44.9	+6.4	Middleburg	79	7	2 stations	11	1 30	4.42	+1.34	Slide Mountain	9.90	Sonyea	1.59
North Carolina	55.6	+5.5	2 stations	85	1 5	Celo	20	1 15	9.02	+6.22	Quebec	21.68	Wadesboro	3.24
North Dakota	29.4	+2.8	Oakes Water Works	68	1	Belcourt Indian Res	−19	28	1.12	+.51	Portal	2.22	Cogswell	.10
Ohio	46.7	+5.2	2 stations	85	5	Batavia, 4 N	18	24	4.31	+1.62	Mt. Healthy	7.85	New Lexington, 1 N	2.14
Oklahoma	48.2	−1.5	Ft. Gibson Dam	91	5	Kenton	12	28	1.76	−.29	Helena	6.81	Randlett	.03
Oregon	38.4	−1.8	Brookings	70	8	Danner	−1	8	4.52	+.78	Valsetz	18.94	Owyhee Dam	.60
Pennsylvania	46.1	+4.7	Uniontown	85	5	Everett	13	30	4.58	+1.66	Meadow Run Ponds	7.64	Beaver Falls	2.42
South Carolina	58.5	+4.6	Ridgeland, 2 SE	87	5	2 stations	27	30	9.00	+6.51	Caesar's Head	17.85	Charleston, WB City	3.50
South Dakota	33.3	+.2	Tyndall	76	15	Hardy R. S	−9	19	1.03	+.38	Deadwood	4.70	Miller	.09
Tennessee	51.1	+2.5	2 stations	84	1 5	Murfreesboro	20	24	10.21	+6.52	Pt. Park, Lookout Mt.	16.98	Butler	4.26
Texas	54.1	−3.0	3 stations	96	1 4	2 stations	10	1 29	1.37	−.75	Bon Wier	11.94	27 stations	.00
Utah	32.9	−4.3	Piute Dam	80	1 2	Woodruff	−12	1 27	.68	−.25	Silver Lake (Brighton)	5.81	7 stations	.00
Virginia	50.9	+4.1	3 stations	83	1 6	Sugar Grove	18	11	6.03	+3.51	Saluda	8.75	Spring Creek	2.73
Washington	38.2	−2.1	Walla Walla, WB City	68	14	Laurier	8	27	6.21	+1.09	Forks	26.83	Ephrata	.62
West Virginia	46.9	+3.6	Madison	89	6	Summersville	17	13	4.31	+1.52	Cranberry Glades	6.57	Smithburg	2.53
Wisconsin	37.6	+4.2	4 stations	73	1	2 stations	4	29	3.17	+1.26	Washington Island	6.73	La Cross, WB Apt	1.73
Wyoming	28.0	−.1	Shawnee	75	2	Bondurant	−28	27	1.05	+.31	Moose	3.56	Lovell	.09
Alaska (Oct.)	28.7	−1.7	Petersburg	67	1	Wiseman	−23	25	4.40	+.73	Whittier	51.81	Unalakleet	.69
Hawaii	71.5	−.4	Lahaina	91	1 1	Haleakala R. S	39	1 2	8.94	+2.10	Pilhonua	38.60	Hirai Camp	.87
Puerto Rico	77.3	+.9	Ponce	98	1 18	Utuado	54	30	8.30	+1.30	San Lorenzo (Espino)	24.96	Lajas	2.32

[1] Other dates also.

CLIMATOLOGICAL DATA FOR WEATHER BUREAU STATIONS FOR NOVEMBER 1948

District and station	Elevation of instruments: Barometer above sea level [1]	Elevation of instruments: Thermometer above ground	Elevation of instruments: Anemometer above ground	Pressure: Station	Pressure: Sea level	Pressure: Departure from normal	Temperature of the air: Averages: Mean maximum	Mean minimum	Mean	Departure from normal	Temperature of the air: Extremes: Highest	Date	Lowest	Date	Greatest daily range	Total heating degree days	Mean temperature of the dew-point	Mean relative humidity	Precipitation: Total	Departure from normal	Greatest in 24 hours	Days with 0.01 inch or more	Days with thunderstorms	Total snowfall (unmelted)	Snow, sleet, and ice on ground at end of month	Wind: Average hourly speed	Prevailing direction	Maximum velocity: Miles per hour	Direction	Date	Character of day (sunrise to sunset), number of days: Clear	Partly cloudy	Cloudy	Average cloudiness, tenths (sunrise to sunset)	Possible sunshine
NEW ENGLAND	*Ft.*	*Ft.*	*Ft.*	*Mb.*	*Mb.*	*Mb.*	°*F.*	°*F.*	°*F.*	°*F.*	°*F.*		°*F.*		°*F.*		°*F.*	%	*In.*	*In.*	*In.*			*In.*	*In.*	*m. p.h.*					*0-3*	*4-7*	*8-10*	*0-10*	%
									44.0	+7.1								83	5.71															7.1	
Caribou [2]	628	5	33	993.2	1,016.9	----	43	30	36.4	+9.2	63	10	20	2	27	857	32	86	4.14	+1.5	.95	17	0	12.7	1.0	----	se.	----	----	----	2	6	22	8.2	--
Eastport	75	67	82	1,014.6	1,017.3	+.7	48	38	42.7	+6.0	59	11	29	29	20	671	36	80	6.35	+3.0	1.80	13	0	T	.0	10.7	s.	38	e.	20	5	5	20	7.4	33
Portland, Me. [2]	103	6	43	1,013.5	1,017.6	-.4	51	34	42.4	+5.1	63	7	21	3	31	676	36	84	6.48	+3.0	2.25	15	0	T	.0	8.7	sw.	36	w.	14	4	7	19	7.6	34
Concord [2]	289	5	45	1,007.1	1,018.0	-.3	52	33	42.5	+7.1	75	6	14	30	35	680	36	84	5.56	+2.5	1.77	15	0	T	.0	6.2	nw.	28	nw.	14	5	9	16	6.9	35
Mt. Washington	6,274	5	37	903.6	1,020.2	----	31	21	26.4	+6.8	50	10	9	14	27	1,163	22	90	9.85	+3.4	2.56	22	0	17.9	5.0	37.4	w.	----	----	----	3	10	17	7.5	32
Burlington [2]	403	6	51	1,001.4	1,016.6	-1.0	52	37	44.4	+8.1	75	6	24	29	33	619	37	81	5.17	+2.5	1.64	15	0	T	.0	9.6	s.	34	s.	10	5	6	19	7.3	41
Boston [2]	124	33	62	1,013.6	1,018.2	+.2	56	43	49.6	+7.6	73	6	28	30	26	461	40	74	5.16	+1.8	2.12	15	1	1.1	.0	10.9	nw.	35	nw.	13	6	7	17	6.7	45
Nantucket [2]	12	4	34	1,018.0	1,018.6	+1.0	55	42	48.8	+4.4	67	5	31	30	23	483	45	88	4.72	+1.5	.99	16	0	.0	.0	12.5	nw.	38	nw.	14	4	9	17	7.1	42
Block Island	26	11	46	1,017.3	1,018.0	.0	55	46	50.6	+6.0	67	6	32	30	17	430	46	84	4.33	+.7	.85	15	0	.0	.0	15.3	nw.	45	nw.	13	6	8	16	6.3	51
Providence [2]	159	65	60	1,012.2	1,018.3	.0	57	42	49.8	+9.4	72	6	28	30	26	458	41	80	5.00	+1.9	1.49	14	1	T	.0	7.9	s.	30	nw.	13	8	7	15	6.5	46
Hartford	159	5	44	1,012.5	1,018.3	-.3	56	37	46.8	+7.3	72	6	22	30	30	547	40	85	6.84	+3.3	2.40	14	1	1.7	1.0	7.4	s.	35	nw.	13	4	10	16	6.8	40
New Haven [2]	107	5	39	1,014.2	1,018.3	-.7	56	40	48.0	+8.1	69	6	24	30	33	513	41	80	4.96	+1.9	2.56	13	1	1.6	T	7.1	w.	22	s.	6	5	10	15	6.4	43
MIDDLE ATLANTIC									51.2	+6.7								80	4.77	+2.2														6.4	
Albany [2]	97	6	40	1,013.5	1,016.9	-1.7	54	36	45.0	+8.7	72	6	22	30	30	597	38	84	4.35	+1.9	1.68	15	1	.7	.0	8.7	se.	39	w.	13	3	9	18	7.2	46
Binghamton [4]	871	57	79	985.8	1,018.0	-.6	55	38	46.3	+7.6	74	6	27	30	33	562	38	82	3.44	+1.0	1.40	17	1	.7	.0	6.0	w.	26	w.	20	2	7	21	7.6	47
New York [4]	314	415	454	1,007.1	1,018.6	-.4	59	46	52.4	+8.2	72	20	34	30	20	380	42	72	3.33	+.4	.80	13	0	T	.0	13.9	nw.	42	w.	13	8	12	10	5.9	58
Allentown [2]	385	4	58	1,004.4	1,018.6	----	57	37	47.2	+5.2	78	6	26	30	35	530	40	82	4.41	+1.6	1.11	17	0	T	.0	----	w.	----	----	----	6	12	12	6.4	--
Harrisburg [2]	374	30	49	1,004.4	1,018.3	-1.7	57	40	48.2	+5.4	77	6	30	30	31	504	39	77	4.57	+2.3	1.11	15	0	2.2	.0	6.9	w.	30	w.	13	8	7	15	6.5	47
Philadelphia [4]	114	174	150	1,013.9	1,018.3	-1.7	59	46	52.6	+6.9	78	6	35	30	28	376	44	82	4.42	+1.7	1.37	16	0	.0	.0	7.5	s.	24	ne.	29	8	9	13	5.9	56
Reading	323	47	306	1,006.4	1,018.6	-1.4	59	42	50.4	+6.5	77	6	31	26	32	439	----	--	4.27	+1.5	1.10	14	1	T	.0	11.2	nw.	40	s.	6	7	9	14	6.3	41
Scranton	805	72	104	988.2	1,018.0	-1.3	56	40	47.7	+7.2	75	6	29	26	31	520	----	--	4.59	+1.8	2.02	11	0	T	.0	6.1	n.	21	nw.	13	3	11	16	7.0	35
Atlantic City	52	37	172	1,016.3	1,018.3	-1.3	58	47	52.6	+7.0	66	10	34	30	17	375	46	82	8.87	+6.0	3.02	14	0	.0	.0	16.3	w.	47	ne.	29	7	8	15	6.3	62
Newark [2]	30	5	46	1,016.9	1,018.3	----	59	42	50.8	+6.8	80	6	28	30	28	433	42	78	2.96	-.5	.74	13	0	T	.0	----	w.	----	----	----	7	9	14	6.3	--
Trenton	190	89	107	1,011.5	1,018.6	-.7	59	44	51.2	+6.8	77	6	32	30	32	417	----	--	3.11	+.4	.85	13	0	.0	.0	8.4	s.	28	s.	6	10	6	14	6.0	46
Baltimore [4]	123	100	215	1,013.9	1,018.3	-1.7	60	46	53.0	+6.7	76	6	37	30	26	363	43	77	5.40	+2.8	2.08	16	2	.0	.0	10.1	s.	38	s.	6	8	8	14	6.1	47
Washington [4]	112	56	100	1,014.2	1,018.3	-2.0	61	44	52.2	+7.0	78	6	33	30	29	389	44	79	5.78	+3.4	1.70	18	6	.0	.0	6.7	s.	29	nw.	13	8	6	16	6.6	51
Cape Henry	18	8	54	1,016.9	1,017.6	-2.4	64	52	57.6	+5.5	81	6	41	26	27	239	52	84	5.85	+3.5	1.53	18	2	.0	.0	12.4	s.	45	e.	28	8	10	12	5.6	62
Lynchburg [2]	686	5	58	992.9	1,018.0	-3.0	60	42	50.8	+5.6	74	6	30	30	30	428	42	80	4.86	+2.5	1.36	17	1	T	.0	8.0	s.	29	s.	6	8	7	15	6.3	42
Norfolk [4]	91	80	125	1,014.9	1,018.3	-2.4	65	52	58.2	+6.8	81	6	42	30	25	227	50	82	5.51	+3.4	1.33	17	2	.0	.0	9.6	ne.	40	se.	28	6	9	15	6.6	47
Richmond [4]	144	11	52	1,012.5	1,017.6	-3.1	64	45	54.5	+6.2	80	5	34	14	30	326	46	86	5.43	+3.2	1.58	19	0	.0	.0	7.2	s.	27	sw.	20	8	12	10	6.1	51
SOUTH ATLANTIC									58.9	+6.1								80	6.63	+4.2														6.4	
Asheville	2,253	77	92	942.8	1,017.6	-4.4	60	41	50.8	+5.7	71	4	30	30	33	423	42	82	7.15	+4.9	2.51	17	2	.0	.0	9.7	se.	29	se.	5	7	8	15	6.3	47
Charlotte [4]	779	63	86	989.9	1,018.0	-3.0	64	47	55.9	+5.3	78	5	36	30	32	280	47	77	8.41	+5.8	3.05	15	3	.0	.0	6.7	ne.	24	s.	6	7	4	19	6.5	43
Greensboro [2]	886	6	56	986.1	1,018.3	-3.0	63	42	52.4	+5.7	76	5	30	26	35	379	44	78	7.72	+5.3	2.04	17	3	.0	.0	7.5	ne.	26	ne.	28	7	10	13	6.4	37
Hatteras	11	5	47	1,017.3	1,017.6	-2.4	69	58	63.5	+7.2	77	10	46	26	23	89	59	86	7.31	+3.8	1.62	17	1	.0	.0	13.0	ne.	30	sw.	27	7	9	14	6.3	49
Raleigh [4]	376	5	71	1,002.0	1,018.3	2.7	66	47	56.8	+5.8	82	5	33	30	32	264	48	80	8.89	+6.6	3.48	17	2	.0	.0	6.7	e.	24	sw.	20	5	9	16	6.7	37
Wilmington	72	73	107	1,016.6	1,018.0	-3.0	70	55	62.6	+6.6	82	10	43	15	26	126	55	85	6.36	+4.4	1.70	17	4	.0	.0	9.1	ne.	30	s.	19	8	7	15	6.2	49
Charleston [4]	48	11	92	1,015.6	1,017.3	-3.4	71	57	64.4	+6.3	81	10	45	30	23	86	56	83	3.50	+1.4	1.05	13	2	.0	.0	9.6	n.	24	sw.	3	7	5	18	6.3	55
Columbia, S. C. [4]	347	70	91	1,009.1	1,017.3	-4.0	69	51	59.7	+5.6	83	5	39	15	33	185	51	81	6.17	+4.2	1.73	14	3	.0	.0	7.7	ne.	27	s.	19	6	6	18	6.5	38
Greenville, S. C. [2]	1,040	18	36	979.7	1,016.9	-3.8	63	46	54.6	+5.0	79	5	32	30	34	321	46	78	12.18	+9.0	3.61	19	2	.0	.0	8.5	ne.	42	ne.	28	9	3	18	6.4	52
Augusta [4]	182	62	77	1,001.7	1,016.9	-3.8	70	51	60.2	+5.7	83	5	37	15	37	173	51	75	6.75	+4.4	1.46	15	4	.0	.0	5.5	nw.	25	w.	19	7	6	17	6.7	47
Savannah [2]	65	19	51	1,015.6	1,017.3	-3.4	75	55	56.8	+7.8	83	10	41	11	32	88	57	79	4.45	+2.4	2.23	10	6	.0	.0	9.5	s.	27	s.	19	6	8	16	6.4	37
Jacksonville [4]	43	86	110	1,015.9	1,017.3	-3.0	78	61	69.2	+7.0	85	5	45	30	28	38	61	81	.63	-1.4	.21	9	3	.0	.0	8.3	s.	26	sw.	28	8	13	9	5.5	56
FLORIDA PENINSULA									77.1	+5.8								80	.85	-1.6														4.7	
Key West [4]	21	10	64	1,015.2	1,015.6	-1.7	84	76	79.8	+5.5	87	27	69	30	13	0	72	80	.51	-1.7	.17	6	0	.0	.0	9.6	e.	26	nw.	29	14	13	3	4.2	68
Miami [4]	25	242	249	1,015.6	1,016.3	-1.7	81	74	77.8	+5.3	87	29	61	30	21	0	69	80	.48	-2.8	.35	5	0	.0	.0	13.3	se.	36	se.	18	8	22	0	4.0	69
Tampa [2]	35	5	36	1,015.9	1,016.6	-2.7	82	65	73.6	+6.7	88	12	48	30	27	7	66	81	1.57	-.2	.87	4	3	.0	.0	7.7	s.	28	s.	19	6	15	9	6.0	57
EAST GULF									59.0	+2.9								81	13.00	+9.7														6.4	
Atlanta [2]	1,173	33	72	981.7	1,016.6	-4.7	64	46	55.0	+3.5	82	5	33	30	26	310	47	78	15.72	+12.6	3.56	17	4	.0	.0	9.2	nw.	30	s.	19	7	5	18	6.5	42
Macon [4]	370	79	87	1,000.0	1,016.6	-4.4	69	48	58.5	+4.3	82	5	34	15	38	226	50	74	10.26	+7.7	3.54	14	5	.0	.0	6.3	n.	27	sw.	19	7	5	18	6.9	40
Thomasville	273	48	----	994.6	1,016.9	-3.1	65	43	54.0	+1.8	84	5	28	11	40	334	48	82	15.06	+11.8	3.21	18	5	.0	.0	----	----	----	----	----	----	----	----	----	----
Apalachicola	35	11	51	1,015.2	1,016.6	-3.7	73	59	66.1	+4.8	80	27	42	30	24	63	6	08	41.24	-1.8	.37	9	3	.0	.0	8.8	se.	40	se.	2	8	9	13	6.0	59
Pensacola [4]	56	54	79	1,011.9	1,016.3	-4.4	71	56	63.4	+3.2	80	5	37	30	25	112	56	80	10.19	+6.5	3.42	14	9	.0	.0	8.3	n.	22	n.	16	6	7	17	6.8	50
Anniston	618	6	32	994.6	1,016.9	-3.1	65	43	54.0	+1.8	84	5	28	11	40	334	48	82	15.06	+11.8	3.21	18	5	.0	.0	----	----	----	----	----	----	----	----	----	----
Birmingham [2]	700	5	63	993.6	1,016.3	-5.4	65	44	54.4	+3.0	80	5	31	11	37	321	47	78	15.25	+11.9	4.87	17	3	.0	.0	8.5	se.	34	se.	16	8	5	17	6.4	39
Mobile [4]	57	86	161	1,008.1	1,016.3	-4.0	70	54	61.6	+3.0	79	1	36	30	29	144	54	82	12.09	+8.4	1.75	16	9	.0	.0	9.2	n.	34	se.	5	6	11	13	6.4	44
Montgomery [4]	218	92	105	1,008.8	1,016.3	-5.0	67	50	58.8	+3.0	84	5	38	11	29	207	50	79	20.10	+16.9	6.82	16	7	.0	.0	7.5	e.	25	s.	5	8	4	18	6.6	46
Meridian [4]	375	67	92	1,004.7	1,015.9	-5.4	68	45	56.6	+2.4	83	4	30	11	38	261	50	83	13.93	+10.6	2.93	14	8	.0	.0	9.7	s.	----	----	----	7	7	16	----	----
Vicksburg [4]	247	82	102	1,005.8	1,015.2	-6.1	66	49	57.6	+1.0	82	4	34	29	33	240	48	83	16.28	+12.6	5.32	12	7	.0	.0	8.5	se.	28	w.	1	9	5	16	6.5	43
New Orleans C. O.	53	76	84	1,013.5	1,015.6	-5.1	72	56	64.4	+2.8	83	5	44	30	25	96	56	82	10.12	+7.0	2.44	14	7	.0	.0	7.0	e.	19	w.	16	9	8	13	6.0	50
New Orleans A. P. [2]	30	6	52	1,013.5	1,015.2	----	72	54	62.8	----	84	5	40	11	31	133	56	83	13.72	----	2.75	18	11	.0	.0	----	s.	----	----	----	6	11	13	6.0	--

See footnotes at end of table.

CLIMATOLOGICAL DATA FOR WEATHER BUREAU STATIONS FOR NOVEMBER 1948—Continued

District and station	Elevation of instruments: Barometer above sea level [1]	Elevation of instruments: Thermometer above ground	Elevation of instruments: Anemometer above ground	Pressure: Station	Pressure: Sea level	Pressure: Departure from normal	Temperature of the air: Averages: Mean maximum	Temperature of the air: Averages: Mean minimum	Temperature of the air: Averages: Mean	Temperature of the air: Averages: Departure from normal	Temperature of the air: Extremes: Highest	Temperature of the air: Extremes: Date	Temperature of the air: Extremes: Lowest	Temperature of the air: Extremes: Date	Temperature of the air: Extremes: Greatest daily range	Total heating degree days	Mean temperature of the dew-point	Mean relative humidity	Precipitation: Total	Precipitation: Departure from normal	Precipitation: Greatest in 24 hours	Precipitation: Days with 0.01 inch or more	Precipitation: Days with thunderstorms	Precipitation: Total snowfall (unmelted)	Precipitation: Snow, sleet, and ice on ground at end of month	Wind: Average hourly speed	Wind: Prevailing direction	Wind: Maximum velocity: Miles per hour	Wind: Maximum velocity: Direction	Wind: Maximum velocity: Date	Character of day (sunrise to sunset), number of days: Clear	Character of day (sunrise to sunset), number of days: Partly cloudy	Character of day (sunrise to sunset), number of days: Cloudy	Average cloudiness, tenths (sunrise to sunset)	Possible sunshine
WEST GULF	*Ft.*	*Ft.*	*Ft.*	*Mb.*	*Mb.*	*Mb.*	°F.	°F.	°F.	°F.	°F.		°F.		°F.		°F.	%	*In.*	*In.*	*In.*			*In.*	*In.*	m. p.h.					*0-3*	*4-7*	*8-10*	*0-10*	%
Shreveport [2]	181	5	64	1,005.8	1,015.2	−5.8	67	45	58.9 55.7	−.1 −.5	86	4	30	30	35	301	47	71 80	2.77 7.03	.0 +3.4	1.83	15	7	.0	.0	9.3	se.	34	sw.	4	11	4	15	5.0 5.8	52
Fort Smith [2]	463	6	30	996.6	1,013.2	−7.1	63	38	50.4	−.6	82	4	19	23	38	444	38	70	1.04	−1.8	.33	7	1	T	.0	8.7	w.	33	w.	19	12	6	12	5.3	54
Little Rock [2]	265	26	58	1,001.4	1,014.6	−6.1	62	43	52.5	+.4	76	16	30	30	35	387	44	77	7.99	+3.8	2.37	13	5	T	.0	8.3	sw.	30	se.	1	10	8	12	5.5	52
Austin [2]	621	5	41	993.9	1,015.6	−4.4	71	46	58.2	−.3	88	4	26	30	38	234	45	68	1.34	−1.0	.85	10	0	.0	.0	9.3	nw.	35	nw.	28	15	7	8	4.2	68
Brownsville [2]	20	5	54	1,011.9	1,013.9	−4.4	78	57	67.3	+.1	92	26	37	29	34	85	57	76	.32	−2.0	.17	5	1	.0	.0	10.0	nw.	34	nw.	28	6	11	13	6.2	52
Corpus Christi [2]	44	6	33	1,014.6	1,015.2	−4.1	76	52	64.4	+1.6	94	4	35	30	32	119	54	74	.64	−1.4	.49	5	0	T	.0	10.4	nw.	37	nw.	28	11	11	8	4.9	57
Dallas [2]	488	34	45	995.9	1,014.9	−5.4	67	44	55.2	−1.2	89	4	26	29	36	318	38	60	.90	−1.6	.58	6	0	T	.0	12.0	s.	38	nw.	19	18	3	9	4.1	69
Fort Worth [2]	706	40	56	990.5	1,014.9	−5.1	67	44	55.6	+1.1	88	4	27	29	35	301	37	58	.50	−2.1	.28	5	0	.0	.0	----	----	----	----	----	18	5	7	3.8	--
Galveston [4]	54	122	129	1,013.5	1,015.2	−5.1	70	57	63.4	+.1	80	1	41	29	24	112	56	80	2.47	−.9	1.47	11	1	.0	.0	12.7	e.	36	nw.	28	9	6	15	6.0	48
Houston [4]	138	157	190	1,010.2	1,015.2	−5.1	71	53	61.9	+.9	85	1	37	29	28	152	51	78	6.14	+2.3	3.05	11	3	.0	.0	10.5	nw.	34	nw.	28	8	6	16	6.2	46
Laredo [2]	418	10	38	1,000.3	1,015.2	-----	75	51	63.0	−.8	96	4	31	29	33	137	45	60	1.03	−.1	.76	4	1	.0	.0	----	w.	----	----	----	18	5	7	4.0	--
Palestine	510	64	72	997.3	1,015.6	−5.1	68	47	57.2	.0	86	4	31	29	31	261	42	62	3.77	+.3	1.60	13	3	.0	.0	8.2	s.	25	w.	18	13	7	10	4.9	57
Port Arthur [4]	34	59	134	1,013.5	1,014.9	−5.1	70	54	62.0	+.9	85	1	37	10	27	139	53	86	4.59	+1.5	1.74	13	4	.0	.0	13.7	n.	37	s.	18	10	8	12	5.8	50
San Antonio [2]	794	6	51	990.9	1,015.6	−4.0	71	44	57.7	−2.6	90	4	25	29	37	241	42	66	1.00	−.9	.57	9	0	.0	.0	8.5	n.	38	nw.	28	18	5	7	3.9	69
OHIO VALLEY AND TENNESSEE																																				
Chattanooga [2]	762	6	66	991.5	1,016.6	−5.1	62	42	48.6 52.1	+4.4 +4.2	80	5	28	25	38	391	44	77 78	6.39 13.59	+3.9 +10.2	4.56	16	3	.0	.0	7.5	s.	32	s.	5	5	10	15	6.4 6.6	41
Knoxville [2]	995	27	71	981.4	1,016.9	−4.4	62	42	52.0	+5.5	84	5	30	11	33	395	43	76	10.36	+7.3	4.06	14	0	.0	.0	7.4	ne.	34	w.	6	8	7	15	6.1	47
Memphis [4]	399	5	49	1,004.7	1,014.9	−6.1	63	42	52.6	+2.5	81	4	28	30	35	379	44	77	9.16	+4.9	2.80	14	5	T	.0	8.3	sw.	32	sw.	5	8	7	15	5.9	51
Nashville [2]	546	5	72	993.6	1,015.6	−6.1	60	42	50.8	+1.8	73	5	24	24	34	425	43	78	7.85	+4.4	2.48	13	4	T	.0	8.5	s.	29	nw.	9	9	8	13	5.8	48
Lexington [2]	989	4	58	980.0	1,016.9	−3.1	57	39	48.0	+3.2	75	5	24	24	29	512	40	77	6.19	+2.8	2.17	17	0	T	.0	----	s.	----	----	----	7	9	14	6.1	--
Louisville [2]	525	5	54	998.0	1,015.2	−5.5	58	40	49.0	+4.0	75	4	25	24	34	480	40	73	8.13	+4.5	3.58	14	1	T	.0	8.1	s.	29	e.	5	8	6	16	6.7	48
Evansville [2]	431	6	40	999.0	1,014.6	−6.4	58	37	47.6	+3.2	76	4	23	24	37	526	40	78	6.14	+2.4	1.50	11	2	.4	.0	9.1	sw.	33	sw.	19	9	6	15	6.2	47
Indianapolis [2]	823	5	54	984.1	1,014.6	−5.4	54	36	44.6	+3.9	71	4	23	24	31	610	38	78	4.93	----	1.92	12	1	.5	.0	11.1	sw.	40	w.	16	7	6	17	6.9	36
Terre Haute [2]	575	4	33	992.9	1,013.9	−6.1	55	36	45.4	+3.0	74	4	21	24	32	590	38	77	4.15	+8.4	1.36	12	2	.6	.0	10.9	s.	34	sw.	19	7	6	17	6.7	47
Cincinnati [4]	627	135	148	992.6	1,015.6	−5.1	58	42	49.8	+5.2	73	4	30	14	30	456	39	75	6.02	+3.2	2.93	15	2	T	.0	4.5	se.	17	w.	13	8	7	15	6.5	45
Columbus [4]	822	90	110	985.8	1,015.6	−4.7	55	41	48.0	+6.1	71	5	30	14	24	510	38	75	3.99	+1.2	1.07	13	1	T	.0	9.6	s.	36	se.	19	9	5	16	6.5	47
Dayton [2]	1,003	6	55	978.3	1,014.9	−5.1	54	38	46.0	+5.6	67	4	28	14	26	573	38	77	5.52	+2.7	2.33	12	1	T	.0	12.7	s.	38	w.	16	6	7	17	6.6	43
Elkins [2]	1,947	5	45	947.5	1,018.0	−3.7	58	32	45.0	+5.7	75	5	21	18	45	603	36	81	3.55	+.7	.95	15	1	T	.0	7.3	s.	35	w.	20	6	8	16	6.6	46
Parkersburg	637	77	84	----	----	----	59	39	49.4	+5.6	83	5	28	25	38	474	39	77	3.67	+1.1	.98	13	0	T	.0	6.5	se.	21	nw.	13	7	7	16	6.6	43
Pittsburgh [2]	842	39	54	985.8	1,016.6	−3.4	56	40	48.0	+6.8	80	5	30	11	33	511	37	74	2.60	+.3	.48	14	0	.8	.0	10.6	s.	33	sw.	13	6	8	16	6.8	42
LOWER LAKES																																				
Buffalo [2]	768	34	96	986.8	1,015.2	−2.8	54	40	46.2 47.1	+7.4 +8.6	76	5	31	14	29	536	38	77 76	3.88 4.01	+1.0 +1.0	1.23	18	0	1.3	.0	13.9	sw.	45	sw.	17	0	7	23	7.7 8.4	17
Canton	448	10	61	999.0	1,015.2	−2.1	52	36	43.9	+8.9	76	6	19	30	29	632	36	79	4.61	+1.4	1.47	17	0	T	T	8.8	sw.	31	sw.	17	2	10	18	7.8	35
Oswego	335	71	85	----	----	----	53	41	47.1	+7.7	74	6	30	29	27	536	----	--	3.79	+.4	.98	17	0	T	.0	9.9	s.	32	nw.	13	0	10	20	8.0	27
Rochester [2]	523	4	69	996.3	1,015.6	−2.7	54	38	46.2	+7.5	74	5	31	14	29	564	38	80	2.92	+.4	1.32	13	0	T	.0	9.7	sw.	38	sw.	17	0	9	21	8.2	32
Syracuse [2]	596	5	57	994.2	1,016.6	−2.0	55	38	46.7	+9.5	75	6	27	30	30	551	38	78	4.34	+1.3	1.59	18	0	1.8	.0	10.0	sw.	34	w.	20	0	5	25	8.4	31
Erie [4]	714	57	81	989.2	1,015.6	−2.7	55	43	48.9	+7.5	77	5	36	29	30	487	36	74	3.99	+.7	.89	16	1	T	.0	10.3	se.	29	sw.	17	2	8	20	7.8	21
Cleveland [2]	762	27	54	986.8	1,014.9	−4.1	55	40	47.0	+8.0	75	5	28	25	28	541	38	75	3.46	+.8	.68	17	0	T	.0	12.3	s.	50	w.	17	3	9	18	7.6	31
Sandusky	629	5	67	991.2	1,014.2	−4.4	53	40	46.8	+5.7	70	5	30	14	24	545	----	--	4.33	+1.9	1.48	15	2	T	.0	10.3	sw.	34	sw	16	6	10	14	6.8	38
Toledo [2]	628	5	47	990.9	1,013.9	−5.4	52	37	44.8	+6.1	67	4	28	25	29	605	38	79	3.74	+1.3	1.38	14	2	T	.0	12.3	sw.	40	sw.	16	4	7	19	7.3	30
Fort Wayne [2]	857	5	34	982.4	1,013.9	−5.4	52	37	44.2	+5.4	66	4	27	14	28	624	38	80	3.36	+.5	1.13	13	2	.4	.0	10.7	sw.	36	s.	16	7	5	18	7.1	42
Detroit [2]	730	5	77	987.5	1,014.2	−4.4	52	40	45.6	+6.4	66	4	31	14	22	580	37	74	4.14	+1.7	1.34	13	2	T	.0	11.1	sw.	36	sw.	16	3	5	22	7.8	25
UPPER LAKES																																				
Alpena	609	5	89	989.5	1,012.2	−4.7	46	37	39.8 41.7	+5.4 +7.3	62	4	28	14	17	701	37	82 84	3.69 2.70	+1.3 +.1	1.51	14	0	.4	.0	11.8	sw.	42	e.	19	0	7	23	8.1 8.8	11
Escanaba	612	51	72	988.2	1,010.8	−6.1	42	35	38.3	+5.2	57	5	25	24	13	802	34	82	5.69	+3.6	1.35	15	1	7.1	T	10.3	w.	35	nw.	16	3	6	21	8.1	20
Grand Rapids [4]	707	70	244	986.1	1,012.2	−5.8	49	39	44.1	+5.7	66	5	29	29	21	625	36	80	2.83	+.1	.80	17	3	T	.0	12.7	sw.	45	sw.	16	1	8	21	8.3	22
Lansing [4]	878	5	90	980.4	1,013.2	−4.8	49	37	42.9	+5.7	66	5	25	29	24	663	36	79	2.49	.0	.67	15	1	T	.0	10.8	sw.	43	w.	17	3	8	19	7.8	25
Marquette	734	44	73	983.1	1,010.5	−6.1	41	33	37.4	+4.1	62	1	22	23	16	832	33	82	5.08	+2.2	1.59	19	0	17.0	1.9	8.1	w.	25	nw.	17	1	5	24	8.5	13
Sault Sainte Marie [3]	614	10	52	988.2	1,011.2	−5.4	42	33	37.4	+7.0	56	6	21	14	20	827	34	88	5.62	+2.6	1.28	23	0	15.5	2.0	10.9	e.	55	w.	17	0	1	29	9.2	6
Chicago [3]	673	5	38	987.5	1,012.5	−6.1	50	36	43.0	+5.3	67	1	23	30	25	656	36	78	2.41	−.1	.75	11	1	T	.0	10.6	s.	35	w.	16	5	6	19	7.3	38
Green Bay	617	5	32	988.2	1,011.2	−5.7	45	34	39.8	+5.8	68	1	23	29	29	755	34	77	4.99	+2.8	1.57	15	4	.7	.0	8.7	sw.	34	w.	16	4	6	22	8.0	29
Milwaukee [3]	681	33	66	986.5	1,012.2	−5.8	47	35	41.4	+5.5	67	1	22	30	23	704	36	80	2.44	+.7	.66	12	2	T	.0	13.5	sw.	44	w.	16	4	7	19	7.4	33
Duluth [4]	1,133	5	47	969.2	1,011.2	−5.7	38	27	32.5	+2.5	61	1	13	23	20	973	26	85	2.63	+1.2	1.88	10	0	5.9	1.2	12.5	w.	37	ne.	19	4	7	19	7.6	34
NORTH DAKOTA																																				
Fargo [2]	940	5	47	976.6	1,012.2	−6.1	36	22	29.7 29.0	+3.4 +1.9	54	3	1	28	29	1,080	26	82 86	.88 .87	+.2 .0	.31	9	0	10.2	2.0	12.7	n.	35	nw.	6	4	4	22	7.4 7.8	19
Bismarck [3]	1,677	5	41	951.2	1,013.2	−6.1	40	23	31.6	+5.1	55	1	11	20	29	1,006	26	80	.70	+.1	.29	9	0	1.1	.0	11.1	nw.	37	nw.	29	5	10	15	7.2	38
Devils Lake	1,478	11	44	957.7	1,012.9	−5.1	34	20	27.0	+2.5	49	3	−2	28	34	1,138	23	82	1.04	+.3	.28	12	0	8.3	3.9	8.7	nw.	27	nw.	6	6	6	18	7.0	40
Williston	1,878	42	50	944.1	1,012.5	−6.1	38	24	31.3	+4.1	48	3	11	20	26	1,008	26	80	.92	+.3	.29	11	0	.5	T	7.1	w.	27	nw.	13	4	6	20	7.4	39
UPPER MISSISSIPPI																																				
Minneapolis-St. Paul [3]	919	43	74	977.0	1,011.2	−6.1	41	29	41.7 35.1	+3.6 +2.7	70	1	16	30	29	897	30	79 81	2.87 1.89	+.8 +.6	.93	11	0	2.5	T	10.3	w.	34	w.	6	3	8	19	7.1 7.8	25
La Crosse [3]	672	5	29	984.8	1,011.2	−7.8	44	32	38.0	+4.3	70	1	14	30	31	810	33	82	1.73	+.2	.81	12	1	1.4	.0	9.5	nw.	34	w.	16	0	10	20	8.3	28
Madison [2]	974	27	39	975.6	1,011.9	−6.4	46	33	39.5	+5.3	69	1	18	30	33	765	34	80	3.56	+1.8	.92	15	2	.9	.0	11.1	w.	38	w.	16	2	9	19	7.6	23
Charles City	1,015	10	51	974.9	1,012.5	−6.1	44	32	38.0	+5.0	68	1	18	22	33	805	----	--	3.33	+1.8	1.31	9	2	.1	.0	6.8	nw.	22	w.	6	7	6	17	7.0	35
Moline [2]	606	6	50	990.2	1,012.9	−6.1	49	33	41.3	+3.8	66	4	19	29	38	709	35	77	2.23	+.4	.59	9	2	T	.0	10.1	w.	31	sw.	16	4	11	16	7.2	31
Des Moines [4]	860	5	99	980.7	1,012.5	−6.1	49	34	41.4	+3.0	72	15	20	22	41	708	34	82	3.27	+1.8	2.07	9	1	.1	.0	9.4	nw.	29	nw.	16	6	8	16	6.8	37
Dubuque	699	60	79	986.1	1,011.5	−7.1	47	34	40.6	+3.6	68	1	19	29	31	735	34	80	2.39	+.7	.81	14	2	T	.0	5.6	s.	20	ne.	19	3	5	22	7.7	27
Burlington [2]	702	4	36	986.8	1,012.9	−6.1	50	33	41.4	+2.8	68	4	16	29	36	709	36	84	2.22	+.2	.97	10	3	T	.0	10.3	s.	37	nw.	16	2	11	17	7.1	37
Cairo	357	5	99	1,001.7	1,014.9	−5.8	59	42	50.4	+3.1	74	4	31	29	28	439	----	--	8.25	+4.6	2.35	11	3	.2	.0	9.8	sw.	36	sw.	19	11	6	13	5.9	56
Peoria [2]	609	7	26	990.5	1,012.9	−6.7	51	34	42.8	+3.0	73	4	19	29	34	664	36	77	1.13	−1.2	.43	6	1	T	.0	10.5	sw.	35	w.	16	6	6	18	7.1	45
Springfield, Ill. [4]	636	5	191	989.8	1,013.5	−5.8	53	35	44.0	+4.1	72	4	21	23	33	632	37	78	1.93	−.6	.99	9	1	T	.0	12.7	sw.	54	w.	16	6	6	18	7.2	32
St. Louis [4]	568	33	59	992.2	1,013.2	−6.1	56	41	48.4	+3.0	71	15	26	29	29	499	38	71	2.46	−.4	.73	12	2	T	.0	12.5	s.	40	nw.	16	10	5	15	5.9	50

See footnotes at end of table.

CLIMATOLOGICAL DATA FOR WEATHER BUREAU STATIONS FOR NOVEMBER 1948—Continued

District and station	Elevation of instruments: Barometer above sea level [1]	Elevation of instruments: Thermometer above ground	Elevation of instruments: Anemometer above ground	Pressure: Station	Pressure: Sea level	Pressure: Departure from normal	Temperature of the air: Averages: Mean maximum	Temperature of the air: Averages: Mean minimum	Temperature of the air: Averages: Mean	Temperature of the air: Averages: Departure from normal	Temperature of the air: Extremes: Highest	Temperature of the air: Extremes: Date	Temperature of the air: Extremes: Lowest	Temperature of the air: Extremes: Date	Temperature of the air: Extremes: Greatest daily range	Total heating degree days	Mean temperature of the dew-point	Mean relative humidity	Precipitation: Total	Precipitation: Departure from normal	Precipitation: Greatest in 24 hours	Precipitation: Days with 0.01 inch or more	Precipitation: Days with thunderstorms	Precipitation: Total snowfall (unmelted)	Precipitation: Snow, sleet, and ice on ground at end of month	Wind: Average hourly speed	Wind: Prevailing direction	Wind: Maximum velocity: Miles per hour	Wind: Maximum velocity: Direction	Wind: Maximum velocity: Date	Character of day (sunrise to sunset), number of days: Clear	Character of day (sunrise to sunset), number of days: Partly cloudy	Character of day (sunrise to sunset), number of days: Cloudy	Average cloudiness, tenths (sunrise to sunset)	Possible sunshine
MISSOURI VALLEY	Ft.	Ft.	Ft.	Mb.	Mb.	Mb.	°F.	°F.	°F.	°F.	°F.		°F.		°F.		°F.	%	In.	In.	In.			In.	In.	m. p.h.					0-3	4-7	8-10	0-10	%
Columbia, Mo. [4]	784	6	66	983.7	1,012.5	−7.1	55	36	45.8	+1.7	78	4	20	29	34	576	35	77	4.21	+2.0	3.01	9	3	T	.0	7.5	sw.	28	s.	4	6	7	17	6.6	52
Kansas City [2]	963	38	76	984.4	1,012.2	−7.4	55	38	46.2	+2.5	71	4	23	22	30	563	35	69	1.69	−.5	1.17	8	2	T	.0	10.5	sw.	38	nw.	16	11	4	15	6.0	49
St. Joseph [2]	967	5	51	982.1	1,012.2	−7.1	54	34	43.9	+2.4	73	15	22	29	39	633	35	77	1.27	−.3	.49	9	3	T	.0	8.3	s.	33	nw.	16	10	5	15	6.0	45
Springfield, Mo. [2]	1,324	5	50	967.2	1,013.2	−6.8	56	36	46.2	+1.2	76	4	20	29	32	567	36	78	3.07	+.3	2.10	11	3	T	.0	13.2	s.	36	sw.	19	12	6	12	5.3	53
Topeka [4]	987	65	87	976.6	1,012.5	−6.8	55	36	45.2	+2.4	73	15	21	22	31	589	34	76	1.41	−.1	1.08	6	1	T	.0	9.2	w.	30	nw.	16	10	5	15	6.0	49
Lincoln [4]	1,189	6	81	969.2	1,012.9	−6.4	48	32	39.8	+.7	70	15	14	22	30	756	32	82	3.62	+2.6	1.76	7	2	4.3	.0	9.5	nw.	34	nw.	5	6	7	17	7.1	42
Norfolk, Nebr. [2]	1,551	5	38	956.3	1,013.2	-----	44	25	34.6	−1.8	74	15	9	21	39	910	28	80	1.10	.0	.56	8	2	9.7	3.0	----	nw.	----	----	----	5	11	14	6.7	--
Omaha [2]	1,105	5	68	976.3	1,012.5	−6.8	48	32	39.8	+1.5	71	15	11	22	31	752	32	78	4.05	+3.0	2.53	7	2	2.0	.0	11.2	n.	35	n.	19	5	8	17	6.8	32
Valentine	2,598	46	54	920.8	1,014.6	−5.0	45	24	34.7	+.1	69	15	12	28	37	909	26	75	.39	−.2	.19	6	0	.4	.0	10.1	w.	30	nw.	5	6	5	19	6.7	50
Sioux City [2]	1,138	5	40	971.9	1,012.9	−6.4	45	27	36.0	+2.0	71	15	8	22	40	871	30	86	4.10	+3.1	3.45	7	0	8.8	T	10.9	nw.	34	nw.	6	5	8	17	6.9	48
Huron [2]	1,301	5	41	965.5	1,013.2	−6.1	43	24	33.4	+1.9	66	11	1	28	37	949	28	82	.24	−.4	.12	5	0	2.3	T	12.1	nw.	36	nw.	6	4	4	22	7.7	34
NORTHERN SLOPE									32.8	+.1								68	.64	+.1													7.4		
Billings [2]	3,570	16	39	888.9	1,015.2	−5.5	45	28	36.2	+.8	64	14	16	30	32	863	20	51	.09	-----	.07	3	0	T	.0	13.9	sw.	47	nw.	10	1	10	19	7.3	45
Butte	5,533	44	58	828.0	1,020.7	-----	36	17	26.4	−2.9	51	14	3	30	29	1,159	21	74	.41	.0	.12	12	0	8.2	T	----	nw.	----	----	----	1	3	26	8.5	--
Glasgow	2,086	34	53	937.7	1,013.9	-- --	42	23	32.4	+4.7	54	1	11	7	34	977	26	74	.69	+.2	.21	10	0	3.4	.0	----	nw.	----	----	----	2	10	18	7.4	--
Great Falls [2]	3,657	16	75	885.5	1,014.2	-- --	43	29	35.6	−.5	58	14	14	27	24	877	23	58	.39	−.3	.22	4	0	3.3	.0	20.2	sw.	52	sw.	28	1	10	19	7.7	31
Havre	2,507	11	67	923.1	1,013.9	−6.4	43	26	34.6	+3.4	56	14	12	27	35	915	25	67	.26	−.4	.08	7	0	1.8	T	10.3	sw.	38	sw.	28	1	11	18	7.5	34
Helena [2]	4,124	5	43	872.3	1,018.3	−2.4	42	26	33.8	+2.0	61	14	14	30	35	939	23	63	.61	+.2	.49	6	0	1.6	.0	10.6	w.	41	nw.	22	1	5	24	7.9	29
Missoula [2]	3,263	4	32	902.8	1,019.6	−1.1	39	25	32.2	+.8	53	14	11	27	24	985	27	80	.92	.0	.30	13	0	5.4	T	5.7	nw.	35	sw.	28	0	1	29	8.9	17
Kalispell	2,973	48	56	911.6	1,016.9	−3.8	38	28	33.0	+.6	51	14	19	27	20	958	28	78	1.50	+.2	.59	15	0	6.3	T	4.8	w.	22	sw.	28	0	5	25	8.7	14
Miles City [2]	2,371	5	28	929.2	1,015.2	−5.5	42	24	33.0	-----	53	3	9	20	30	957	26	74	.49	-----	.16	8	0	1.5	.0	----	nw.	----	----	----	4	7	19	7.4	--
Rapid City [2]	3,259	5	56	899.1	1,013.9	−6.4	44	24	34.1	−.5	62	2	8	20	39	926	24	72	.29	−.2	.11	7	0	1.6	.0	16.5	nw.	56	nw.	4	5	12	13	6.4	47
Cheyenne [2]	6,094	22	40	808.0	1,016.3	−3.3	42	21	31.2	−3.6	63	14	8	27	35	1,017	18	60	.32	−.2	.13	7	0	3.5	.0	15.1	nw.	48	nw.	24	7	10	13	6.2	44
Lander [2]	5,352	6	30	826.6	1,018.0	−4.0	41	17	28.8	−1.5	60	1	4	8	35	1,086	17	64	1.23	+.6	.58	7	0	20.7	2.0	5.8	se.	38	w.	13	5	13	12	6.1	50
Sheridan [2]	3,790	5	38	876.1	1,016.3	−4.0	43	22	32.3	−.4	59	14	8	19	38	980	23	68	1.05	+.4	.46	12	0	5.3	.0	10.4	nw.	45	nw.	13	2	10	18	7.2	31
North Platte [2]	2,821	11	51	913.3	1,014.6	−5.4	46	24	35.0	−1.6	75	15	14	23	46	902	26	74	.77	+.3	.28	8	0	5.0	.0	11.9	nw.	--	-----	--	6	8	16	6.7	49
MIDDLE SLOPE									42.6	−1.1								64	1.53	+.4													5.2		
Denver [4]	5,292	106	113	835.1	1,016.3	−3.7	49	28	38.6	−1.2	73	14	15	19	34	787	16	48	.63	+.1	.28	7	0	9.3	.0	8.4	s.	34	n.	18	9	14	7	5.1	68
Pueblo [2]	4,690	5	36	850.7	1,015.9	−3.7	54	21	37.4	−.9	73	2	2	28	50	831	16	46	.01	−.4	.01	1	0	.8	.0	8.9	nw.	40	nw.	24	9	9	12	5.5	61
Concordia	1,392	50	58	962.8	1,013.5	−6.5	50	33	41.2	−.2	72	15	23	20	31	711	32	72	2.02	+1.0	1.26	7	0	3.9	.0	9.3	nw.	42	n.	19	11	8	11	5.5	52
Dodge City [2]	2,509	5	58	921.8	1,013.9	−6.1	50	29	39.5	−3.1	76	17	15	28	38	761	30	75	1.98	+1.2	.62	7	0	13.2	3.0	17.2	nw.	55	nw.	18	12	4	14	5.4	53
Wichita [2]	1,358	52	64	962.4	1,012.9	−6.4	53	35	44.0	−.8	69	3	22	29	31	630	34	72	3.30	+1.9	1.86	7	1	3.6	T	14.4	s.	40	n.	16	13	3	14	5.4	57
Oklahoma City [4]	1,214	10	47	969.9	1,013.9	−6.1	59	39	48.8	.0	77	4	25	29	32	490	34	64	1.78	−.1	1.43	4	1	.6	.0	10.2	s.	26	n.	28	15	7	8	4.5	62
Tulsa [2]	674	10	60	988.5	1,013.2	-----	60	37	48.6	−.3	84	4	22	23	37	492	36	70	1.00	−1.1	.63	7	2	T	.0	11.9	s.	33	n.	28	13	5	12	5.0	61
SOUTHERN SLOPE									49.7	−2.0								54	.56	−.7													3.2		
Abilene [2]	1,755	4	59	952.9	1,014.6	−5.0	65	41	52.7	+.1	82	3	21	29	42	378	34	52	T	−1.4	T	0	0	.0	.0	16.8	s.	43	nw.	5	17	8	5	3.5	79
Amarillo [2]	3,604	5	42	886.8	1,014.3	−5.0	56	29	42.4	−1.4	74	17	17	28	43	675	28	62	2.11	+1.2	.08	3	1	.7	.0	15.7	nw.	52	nw.	18	17	8	5	3.9	62
Del Rio	960	63	71	981.4	1,015.2	−4.8	69	46	57.5	−2.5	91	4	25	29	35	249	40	56	.38	−.9	.25	4	0	.0	.0	8.6	nw.	32	nw.	27	20	5	5	2.9	80
Roswell	3,614	6	29	890.6	1,015.6	−3.4	63	26	44.6	−3.5	83	17	14	29	58	616	18	41	T	−.8	T	0	0	T	.0	8.1	n.	42	w.	17	23	5	2	2.4	84
Wichita Falls	1,030	4	49	977.3	1,014.2	-----	64	39	51.3	−2.8	80	4	22	29	41	411	34	58	.30	−1.4	.26	4	2	T	.0	----	----	----	----	----	17	9	4	3.4	--
SOUTHERN PLATEAU									48.9	−3.0								35	.03	−.7													2.3		
El Paso [2]	3,916	35	85	886.6	1,015.6	−2.4	63	33	47.9	−3.2	76	17	18	29	37	512	20	32	T	−.5	T	0	0	.0	.0	10.6	n.	42	w.	4	23	5	2	2.3	90
Albuquerque [2]	5,314	5	45	837.1	1,015.9	−2.7	53	28	40.6	−2.7	71	3	16	28	35	733	19	44	.11	−.4	.11	1	0	T	.0	9.1	nw.	43	nw.	17	16	13	1	3.1	84
Flagstaff	6,907	34	48	790.4	1,020.0	+3.4	50	20	35.3	−1.9	64	1	9	30	49	891	14	43	T	−1.3	T	0	0	T	.0	----	w.	----	----	----	18	11	1	2.8	--
Phoenix [4]	1,107	39	87	976.6	1,016.3	+1.6	72	42	57.0	−2.7	82	2	34	28	39	242	25	35	.00	−.7	.00	0	0	.0	.0	5.8	e.	24	w.	8	26	3	1	1.7	98
Tucson [2]	2,555	5	39	926.5	1,015.6	+.7	70	38	53.6	−4.1	81	2	29	28	45	344	20	28	.06	−.8	.06	1	0	.0	.0	7.9	se.	36	nw.	26	25	3	2	1.9	98
Yuma	142	9	54	1,008.8	1,016.3	.0	74	45	59.2	−3.2	85	3	37	23	38	181	26	28	.00	−.3	.00	0	0	.0	.0	6.7	nw.	41	n.	8	26	3	1	1.9	97
MIDDLE PLATEAU									34.4	−3.5								63	.58	−.1													5.5		
Ely [2]	6,262	8	41	810.7	1,022.0	-----	46	15	30.4	−2.3	62	14	5	25	46	1,036	18	58	.10	−.6	.04	4	0	1.3	1.0	10.5	s.	29	nw.	3	9	9	12	5.4	69
Reno [2]	4,527	20	52	866.2	1,022.7	+1.7	57	20	38.2	−1.5	70	13	7	27	50	806	22	56	T	−.6	T	0	0	T	.0	7.2	n.	45	se.	1	15	11	4	3.9	80
Winnemucca	4,339	5	56	871.7	1,022.7	+.3	50	21	35.3	−3.1	65	14	9	28	45	889	24	63	.38	−.3	.12	8	0	1.3	1.0	7.6	sw.	39	nw.	30	7	11	12	6.2	50
Salt Lake City [2]	4,357	32	58	870.0	1,021.3	.0	44	26	35.4	−4.0	64	14	13	27	28	890	27	70	1.71	+.6	.33	17	1	11.2	1.7	8.6	se.	38	nw.	24	5	11	14	6.5	57
Grand Junction [2]	4,602	5	26	854.4	1,022.4	+2.8	43	22	32.5	−6.8	62	1	9	28	30	973	22	70	.70	+.3	.27	8	0	7.2	T	6.4	e.	29	nw.	17	10	9	11	5.5	51
NORTHERN PLATEAU									36.5	−1.2								75	1.73	−.1													7.7		
Baker [4]	3,471	36	54	898.4	1,022.4	.0	42	25	33.3	−2.7	57	14	13	8	30	954	25	74	.93	−.1	.33	15	0	7.8	2	5.6	se.	30	sw.	14	1	10	19	7.6	46
Meacham	4,056	7	28	878.1	1,021.7	-----	38	25	31.7	-----	53	14	13	8	28	999	27	82	3.77	-----	.72	21	0	23.2	8	----	se.	----	----	----	1	3	26	9.0	--
Boise [2]	2,739	5	49	923.8	1,022.0	−1.0	46	28	37.0	−2.7	62	14	16	8	34	840	28	70	1.02	−.3	.32	11	0	5.5	2	9.9	se.	32	w.	3	2	9	19	7.6	43
Lewiston	1,436	4	23	967.8	1,020.7	-----	47	32	39.6	-----	56	22	21	9	21	761	32	72	.96	-----	.24	12	0	1.6	0	----	s.	----	----	----	1	5	24	8.4	--
Pocatello [2]	4,478	5	31	865.2	1,022.0	.0	42	26	33.8	−.3	60	14	10	8	26	935	25	69	2.44	+1.4	.58	15	0	7.9	1	11.5	sw.	32	sw.	3	1	13	16	7.7	38
Ellensburg [2]	1,735	5	58	955.3	1,019.3	-----	45	27	35.8	−.4	56	10	15	8	32	881	30	82	1.08	−.4	.45	11	0	5.3	0	----	nw.	----	----	----	6	7	17	6.8	--
Spokane [2]	1,929	6	51	948.9	1,019.3	−2.0	41	28	34.8	−3.7	53	14	18	27	20	909	29	78	2.38	+.3	.67	14	0	8.0	T	9.3	sw.	36	sw.	28	3	7	20	7.6	28
Walla Walla	991	57	65	983.7	1,020.3	−1.0	51	37	44.0	+1.2	68	14	25	21	25	627	----	--	1.91	−.1	.60	11	0	T	0	6.6	s.	25	w.	16	1	9	20	7.9	38
Yakima [2]	1,076	4	54	980.0	1,020.0	−.7	50	27	38.2	+.1	58	10	18	8	33	808	30	74	1.12	−.1	.46	8	0	3.0	0	----	w.	--	----	--	7	9	14	6.4	--

See footnotes at end of table.

CLIMATOLOGICAL DATA FOR WEATHER BUREAU STATIONS FOR NOVEMBER 1948—Continued

District and station	Elevation of instruments: Barometer above sea level [1]	Elevation of instruments: Thermometer above ground	Elevation of instruments: Anemometer above ground	Pressure: Station	Pressure: Sea level	Pressure: Departure from normal	Temperature of the air: Averages: Mean maximum	Mean minimum	Mean	Departure from normal	Temperature of the air: Extremes: Highest	Date	Lowest	Date	Greatest daily range	Total heating degree days	Mean temperature of the dew-point	Mean relative humidity	Precipitation: Total	Departure from normal	Greatest in 24 hours	Days with 0.01 inch or more	Days with thunderstorms	Total snowfall (unmelted)	Snow, sleet, and ice on ground at end of month	Wind: Average hourly speed	Prevailing direction	Maximum velocity: Miles per hour	Direction	Date	Character of day (sunrise to sunset), number of days: Clear	Partly cloudy	Cloudy	Average cloudiness, tenths (sunrise to sunset)	Possible sunshine
NORTH PACIFIC COAST	*Ft.*	*Ft.*	*Ft.*	*Mb.*	*Mb.*	*Mb.*	°F.	°F.	°F.	°F.	°F		°F.		°F.		°F.	%	*In.*	*In.*	*In.*			*In.*	*In.*	*m. p. h.*					0-3	4-7	8-10	0-10	%
									42.8	−1.6								83	6.97	+1.1														8.1	
Kelso [2]	750	38	76				49	34	41.8	.....	55	5	23	8	26	694	39	86	8.62	.....	1.53	24	0	0	0	.....	s.	..	.....	..	1	3	26	8.7	..
North Head	211	5	55	1,012.2	1,020.0	+2.0	49	41	45.7	−3.1	53	5	36	8	13	599	42	86	9.06	+.6	1.61	26	0	0	0	18.0	se.	67	se.	16	1	9	20	7.9	31
Seattle [4]	125	90	321	1,014.9	1,019.6	+1.0	50	40	45.0	−1.8	54	22	34	8	15	602	39	84	6.07	+1.0	1.32	22	3	T	0	12.4	se.	47	sw.	14	2	7	21	8.0	22
Tacoma	194	172	201	1,012.5	1,019.6	+1.3	49	38	43.6	−1.0	54	22	30	8	16	638	.....	..	6.06	−.2	1.02	20	1	T	0	11.4	s.	34	s.	27	2	8	20	7.9	24
Tatoosh Island	86	5	61	1,014.2	1,017.6	+1.0	49	41	45.0	−.9	51	14	36	26	14	603	40	84	17.60	+5.7	2.81	23	0	0	0	17.8	w.	66	s.	29	1	6	23	8.4	21
Burns	4,162	35	47	876.1	1,022.0	.....	45	23	33.8	−1.4	56	12	13	18	40	936	26	71	1.34	.0	.78	10	0	5.0	1	.....	w.	..	.....	..	1	15	14	7.1	..
Eugene [3]	433	4	35	1,008.8	1,023.0	.....	50	34	42.4	.....	60	2	24	9	26	679	40	80	6.19	.....	.92	21	1	0	0	.....	s.	..	.....	..	2	4	24	8.3	..
Medford [3]	1,329	29	58	975.3	1,024.4	+3.4	52	31	41.4	−2.5	65	1	23	8	37	707	36	83	2.57	+.2	.56	13	0	T	0	.....	n.	..	.....	..	1	7	22	7.9	..
Portland, Oreg. [4]	154	68	106	1,016.3	1,022.0	+2.4	50	40	45.2	−1.6	58	22	35	11	16	593	39	84	7.75	+1.6	1.34	22	0	0	0	6.4	se.	24	s.	27	1	8	21	8.5	16
Roseburg	510	45	76	1,004.7	1,023.7	+3.4	52	38	45.0	−.9	64	2	26	8	25	600	.....	..	4.45	−.2	1.05	17	0	T	0	4.0	sw.	25	sw.	1	0	3	27	8.6	21
MIDDLE PACIFIC COAST																																				
									52.8	−1.0								66																4.8	
Eureka	60	72	88	1,022.0	1,024.4	+4.1	55	41	47.7	−3.4	65	2	34	27	24	518	44	83	3.19	−2.0	.83	14	0	.0	.0	6.5	se.	28	sw.	1	6	8	16	6.7	53
Red Bluff [3]	353	5	26	1,008.5	1,021.3	.....	64	42	53.2	−.6	82	10	27	28	35	358	34	52	1.01	−2.0	.58	7	0	.0	.0	8.2	nw.	37	se.	1	13	6	11	5.1	71
Sacramento [4]	66	92	115	1,018.6	1,021.0	+1.7	64	43	53.5	−.1	72	12	33	27	30	347	37	61	.59	−1.3	.30	6	0	.0	.0	6.9	nw.	27	nw.	7	17	7	6	3.7	72
San Francisco [4]	155	112	132	1,015.6	1,021.3	+2.0	64	49	56.6	+.3	73	13	42	28	25	256	43	70	1.18	−1.2	.51	8	0	.0	.0	6.9	w.	27	w.	25	17	6	7	3.8	72
SOUTH PACIFIC COAST																																				
									58.3	+.8								58	.04	−.9														2.8	
Fresno [3]	327	5	34	1,008.8	1,021.3	+1.7	68	37	52.9	+.5	79	14	27	29	40	364	36	57	.02	−.9	.02	1	0	.0	.0	3.8	nw.	29	nw.	26	16	11	3	3.7	90
Los Angeles	338	236	263	.....	.....	.....	75	49	62.1	+1.2	86	6	42	27	33	101	.....	..	T	−1.2	T	0	0	.0	.0	6.8	e.	37	nw.	26	21	8	1	2.5	93
San Diego [3]	87	20	55	1,013.9	1,016.9	.0	72	48	60.0	+.7	79	6	40	27	32	152	43	58	.10	−.7	.06	4	0	.0	.0	5.0	n.	20	nw.	26	22	7	1	2.3	92
WEST INDIES																																				
San Juan, P. R.	82	9	54	1,010.8	1,013.5	.....	83	74	78.6	+.2	87	2	71	30	12	0	74	86	7.49	+.7	1.55	23	7	.0	.0	9.2	e.	30	e.	18	2	15	13	6.7	35
ALASKA																																				
Anchorage [3]	132	6	44	995.6	1,000.7	.....	21	7	14.2	−8.2	43	10	−20	27	23	1,523	10	77	1.36	+.3	.61	8	0	10.4	3.0	5.7	n.	26	s.	10	7	6	17	6.4	40
Annette Island	113	5	53	1,003.1	1,007.1	.....	43	35	39.2	.....	49	21	21	28	13	773	36	86	12.09	.....	1.64	28	0	7.2	T.	.....	s.	..	.....	..	0	5	25	8.7	..
Barrow	29	5	27	1,011.2	1,011.5	.....	2	−12	−5.2	.....	28	11	−40	25	34	2,105	−7	84	.12	.....	.04	6	0	1.8	10.0	10.1	se.	31	e.	3	6	14	10	5.9	..
Bethel [3]	28	5	31	1,003.1	1,004.4	.....	15	5	10.1	.....	37	7	−23	30	25	1,649	8	85	.77	.....	.34	10	0	5.6	1.0	10.7	s.	34	.....	22	12	3	14	5.4	..
Cordova [3]	45	5	32	994.9	996.6	.....	32	15	23.4	−6.8	47	2	−17	27	33	1,248	23	95	9.02	−.4	3.52	20	0	27.3	14.0	.....	e.	..	.....	..	4	6	20	7.5	..
Fairbanks [3]	455	5	63	990.5	1,008.8	.....	4	−8	−2.0	.....	48	10	−38	26	32	2,011	−6	78	.54	.....	.20	12	0	5.9	2.0	3.2	n.	20	s.	10	9	3	18	6.4	35
Juneau [3]	80	6	30	1,000.3	1,003.4	.....	36	28	31.8	−.2	49	2	−3	28	22	996	27	82	10.38	+5.0	1.71	26	0	27.5	6.0	11.2	se.	36	se.	3	2	0	28	8.9	6
Kotzebue [3]	20	5	31	1,008.1	1,008.5	.....	5	−7	−1.0	.....	34	10	−36	24	24	1,978	−3	85	.35	.....	.11	11	0	3.9	7.0	8.1	ne.	36	se.	26	7	7	16	6.3	..
McGrath [3]	341	5	31	993.6	1,007.1	.....	5	−13	−4.1	−6.5	35	10	−49	25	30	2,073	−3	80	1.11	+.1	.48	12	0	14.1	14.0	.....	nw.	..	.....	..	12	3	15	5.2	..
Northway [3]	1,718	5	32	942.4	1,008.5	.....	1	−13	−5.9	.....	31	11	−55	27	26	2,131	.....	..	.60	.....	.14	12	0	10.3	12.0	.....	nw.	..	.....	..	4	6	20	7.9	..
HAWAII																																				
Honolulu [4]	38	86	98	1,014.2	1,015.6	.....	79	70	74.8	+.3	82	6	64	29	12	0	65	71	3.10	−.7	2.05	18	2	.0	.0	9.7	ne.	28	ne.	28	1	17	12	7.1	58

[1] Height of barometer cistern above mean sea level on January 1, 1900, or when station was first established since January 1, 1900. When station is moved to new location or airport, the pressure is reduced to the original elevation for homogeneity. These elevations do not represent the present station elevation in most cases.

[2] Data are from airport records. Pressures adjusted to original elevations according to note [1].

[3] Barometric, hygrometric, wind, character of day, and average cloudiness data from airport records; remainder from city office records.

[4] Barometric and hygrometric data from airport records, remainder from city office records.

[5] Barometric, temperature, degree day, and hygrometric data from airport; remainder from city office records.

NOTE.—Unless otherwise indicated, data in table are city office records.

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SEVERE LOCAL STORMS FOR NOVEMBER 1948

[The table hereunder contains such data as have been received concerning severe local storms that occurred during the month. A revised list will appear in the United States Meteorological Yearbook]

Place	Date	Time	Width of path, yards	Loss of life	Value of property destroyed	Character of storm	Remarks
Oregon, northern coast	2-3		[1] Several	3	$6,000	Winds and high tides.	Extremely high tides, accompanied by 40 m. p. h. winds, caused much shore line erosion, isolated some peninsular communities; disrupted power and water service at Bay City near Tillamook; damaged many beach cottages; and damaged a natatorium. Much damage not included in estimate. 3 duck hunters drowned when their boat overturned.
Arkansas, entire State	4-5	Afternoon, 4th, morning, 5th.			60,000	Hail and wind	Thunderstorms accompanied passage of "Cold Front" from northwest across State. Damage widespread, but minor except in central portion of State. Major damage at Searcy night of 4th when 2 hangars destroyed and 9 planes damaged to extent of $30,000. $5,000 damage at Arkadelphia, mostly by hail to 3 greenhouses. Hailstones up to 2 inches in diameter. Remaining $25,000 damage from broken windows, damaged roofs, and utilities over State.
Rapides through LaSalle to Catahoula Parish, La.	5	12:30-2:30 a. m.	100	1	320,000	Tornado	Developed near Alexandria and moved northeastward to vicinity of Vicksburg, Miss. Path about 120 miles long. Greatest damage at Harrisonburg and Sicily Island in Catahoula Parish. 19 persons injured. 51 buildings destroyed and 40 damaged. No material damage to crops, as harvesting practically over.
Crenshaw and Pike Counties, Ala.	5	1:30-3 a. m.			40,000	Thundersqualls	5 persons injured, 4 cabins destroyed, 35 other dwellings damaged, and 33 miscellaneous buildings damaged or destroyed.
Rochester, Ky	5	4:30 a. m.	880	0	25,000	Tornado	School unroofed and gymnasium building almost completely destroyed. Many farm buildings and stored crops seriously damaged.
Benton, Yazoo County, Miss.	5	5 a. m.	100	9	450,000	do	Path 15 miles long. High winds at all stations in Yazoo and nearby counties. 39 persons injured. 95 buildings destroyed, 35 damaged.
Cecelia, Ky	5	5:45 a. m.	50	1	50,000	do	1 residence completely demolished. Many other buildings severely damaged. Many cows, chickens, and other livestock killed. Much corn, tobacco, and wheat, stored in barns, scattered and destroyed. 1 injury.
Vicksburg, Miss	5	6 a. m.		0	10,000	do	Believed to be same tornado which passed through Rapides, LaSalle and Catahoula Parishes, Louisiana, earlier. Damage mostly to trees and roofs.
Ripley, Tippah County, Miss.	5	6:30 a. m.	150	1	100,000	do	Length of path unknown, may have crossed into Tennessee. 13 persons injured. 24 buildings destroyed, 2 damaged.
Giles and Maury Counties, Tenn.	5	1 p. m.	[1] 3	0	11,400	do	Gales from Yokley community to Southport. Wires blown down; tobacco damaged when barns blown apart; church unroofed; and 8 to 10 houses and barns damaged.
Bowdon (near), Carroll County, Ga.	5	6:30-6:32 p. m.	100	0	5,950	do	First in series of 3 storms that struck between Bowdon and Cedartown. Moved northward over path approximately 2 miles long. Most damage in farm section just beyond western limits of Bowdon. No injuries, 2 homes badly damaged; the upper floor of one practically demolished with furnishings scattered widely. Several barns destroyed and several small houses damaged. Trees uprooted; some of which, in falling, injured livestock and tore down power lines. 2 mules hurt and 50 or more chickens killed. Several bales of cotton blown away. "Live" wires blown down across highway. Estimate includes $500 crop loss.
Cedartown, Polk County, Ga.	5	6:40-6:41 p. m.	200	0	125,000	do	Storm from southwest, cut diagonal path through Cedartown, barely missed the downtown area, and was quickly over. Worst storm ever to strike Cedartown. 4 residences and several other buildings destroyed; 70 buildings heavily damaged, with lesser damage to at least 60 other buildings; many windows broken and signs, doors, etc., blown off. Considerable damage to power and telephone lines. 2 persons painfully injured, and several others sustained minor cuts and bruises.
Buchanan vicinity, Haralson County, Ga.	5	Late evening		0		do	Information incomplete. Storm apparently less severe than at Bowdon.
Prairie du Chien, Wis	6	4 a. m.		2		Wind	2 men drowned when waves swamped boat.
Pine Grove, Pa	6	Night			6,000	Electrical	Lightning damaged a barn.
Ghent, N. Y	13	3:30 p. m.	440		8,000	Wind	Winds of near tornadic force destroyed a highway department garage and damaged road machinery stored therein.
Boston, Mass., and suburbs	13	5:30—6 p. m.				Electrical and wind	Short, intense thunderstorm with wind squalls reaching 40 m. p. h., disrupted plane, train, and bus services. High wind and lightning felled branches and trees, which pulled down light, power, and telephone lines.
Lemoyne, Pa	13					Wind	Tree blown down in path of automobile; this car and following car crashed; 6 people injured.
Washington, northern coastal area.	16	7 a. m.—10 p. m.		6	86,600	Winds	High winds, accompanying a maritime disturbance, reached an extreme velocity of 49 m. p. h. from southwest at Seattle. Considerable damage to small craft, harbor installations, and breakwaters in Straits of Juan de Fuca, extending from Neah Bay to Port Townsend. 2 tugboats sunk in comparatively shallow water near Port Townsend and 1 off mouth of Columbia River; 6 lives lost. Important damage to telephone and power lines as far south as Seattle. Loss of the 3 tugs not included in estimate.
Columbia and Hattiesburg, Miss.	16	Noon			10,000	do	Damage to trees and roofs.
Walker, Livingston Parish, La.	16	12:35 p. m.			95,000	do	7 buildings destroyed, 10 damaged. 1 person injured. 200 school children escaped, when gymnasium collapsed.
White Hall (near), Ill	16	1:35 p. m.				do	Bus overturned after gusty winds forced it off highway; driver injured.
Cambridge, Henry County, Ill.	16	1:45 p. m.			10,000	do	Several fairground buildings damaged. Many small farm buildings destroyed and others lost roofs. Several trees blown down in Cambridge.
Geneseo, Henry County, Ill.	16	do				do	Several telephone poles broken and some trees uprooted in rural areas.
Jacksonville, Ill	16	2 p. m.			1,500	do	8 large glass window panes smashed in showroom, damaging new car.
Dickson Mounds, Fulton County, Ill.	16	do				do	Rural school unroofed, outbuildings damaged, and trees uprooted.
Williamsville-Sherman area, Sangamon County, Ill.	16	2:15 p. m.			15,000	do	7 farms suffered considerable damage to homes and outbuildings.
Decatur, Ill	16	2:45 p. m.				do	3 small airplanes damaged at Decatur Municipal Airport.
Missouri, entire State	16	Afternoon				do	Straight-line winds, reaching 62 m. p. h. in gusts at St. Louis Municipal Airport, caused minor damage in St. Louis area to trees, signs, wires, plate glass windows, and steeple of a church. At Martinsburg, a plate glass window blown out and 1 person slightly injured by flying glass.
Waukegan, Ill	16	4:05 p. m.				do	Winds up to 81 m. p. h. blew down several trees and partially disrupted utility services.

[1] Miles instead of yards.

SEVERE LOCAL STORMS FOR NOVEMBER 1948—Continued

[The table hereunder contains such data as have been received concerning severe local storms that occurred during the month. A revised list will appear in the United States Meteorological Yearbook]

Place	Date	Time	Width of path, yards	Loss of life	Value of property destroyed	Character of storm	Remarks
Pontiac, Ill	16	4:30 p. m.				Wind	3 airplanes damaged at Chief City Airport.
Wisconsin, southern portion	16	5:30 p. m. to midnight.		1	15,000	Wind and electrical	Granary, tool shed, and hog barn destroyed. Light and telephone lines disrupted. Trees downed; buildings and advertising signs damaged. 9 persons injured in traffic accidents. Lightning struck radio tower of station WLIP at Kenosha, knocking out a coupling. 1 man drowned in Lake Butte des Morts.
Honolulu, Oahu, T. H	17	P. m.			12,000	Rain	Chief damage upper Manoa and Palolo Valley areas; several bridges washed away.
Michigan, entire State	17–18	Evening and early morning.			50,000	Winds	An intense "Low" moved across Michigan, causing unusually high winds which damaged many trees, buildings, and curtailed for a time navigation on the Great Lakes. Communication and power facilities damaged. Unusually low tides along some lake shores.
Franklin and Richland Parishes, La.	18	6:30–7:30 a. m.	150	0	125,000	Tornado	High winds over entire State, with many reports of slight damage. 12 persons injured, mostly at Delhi. 17 buildings destroyed, 15 damaged.
E. Felicians Parish, La	18	Morning				Wind and hail	
Louisiana, northeastern portion.	18	All day				Rain	Some of the heaviest rain of record in area from Rapides Parish northeastward to East Carroll Parish. Streams flooded; some highways covered. Reported that Red River below Alexandria rose 12 feet on 19th–20th. Remnants of cotton in fields damaged.
Magnolia and southern Columbia County, Ark.	18	Afternnoo			10,000	Wind	Covered wide area during thunderstorm, from Magnolia south to Arkansas-Louisiana border. Damage mostly to roofs, outbuildings, trees, and utility lines, especially at Magnolia.
Caddo Parish, La	18	do			75,000	do	Oil derricks on Caddo Lake demolished.
Lamar County, Miss	18	3 p. m.			20,000	do	8 buildings destroyed, 16 damaged. 2 persons injured.
Alcorn County, Miss	18	7:30 p. m.			5,000	do	12 buildings damaged.
Union County, Miss	18	do			30,000	do	6 buildings destroyed.
Calhoun City, Miss	18	do	150	0	250,000	Tornado	Path about 30 miles long. 25 persons injured. 55 buildings destroyed, 60 damaged.
Lake Charles, La	18	do			20,000	Wind	Occurred just ahead of wind shift. Homes and garages damaged, trees uprooted. Gusts to 60 m. p. h. at Weather Bureau Office.
Lauderdale County, Ala	18	10 p. m.			20,000	Thundersqualls	1 cabin destroyed, 17 other dwellings damaged, and 23 other buildings damaged or destroyed.
Kansas, western two-thirds	18–19	Began about midnight, 18th.		3		Blizzard	Winds of 60 m. p. h. with snowfalls of 4 to 10 inches. Visibility zero to ¼ mile at times and drifts 6 to 20 feet deep. All traffic paralyzed and wire service disrupted. Most highways in a 19-county area closed 2 to 4 days and train service suspended from 48 to 72 hours and some branch lines out of operation for 10 days. Many automobiles stalled on highways. 5 percent of cattle and 25 to 40 percent of sheep lost in some areas, totalling altogether several million dollars.
South Dakota, southeastern portion.	18–19	8:28 a. m. 18th—4 p. m. 19th.		1		Snow and wind	High winds drifted snow; averaged depth 4 to 15 inches; some drifts 15 feet high. Temperatures around 25°. Traffic halted from 1 to 2 days.
Nebraska	18–19		[1] 300	4		Blizzard	Snowfalls of 8 to 20 inches over central and northeastern areas and smaller amounts elsewhere; driven by winds reaching gale force. Highways west of Lincoln closed for a few days; blocked in northeast. Communication and power lines disrupted. Supplies could not get to numerous communities for 2 to 5 days. Livestock losses not serious, but a large loss of turkeys in Grand Island area and neighboring counties. Many persons marooned. Much interruption of air line, railroad, and bus services. Damage estimated in hundreds of thousands of dollars.
Iowa, northwestern portion	18–20	Noon 18th—noon 20th.				Snow, sleet and wind.	Highways slick by 5 p. m., 18th. Early on 19th, heavy rain and some thunder followed by heavy sleet and strong north winds; then snow and blowing snow with temperatures slightly below freezing. Blizzard-like conditions afternoon of 19th blocked highways and stopped travel. Area affected in Iowa approximately north of a line from Sioux City to Storm Lake to Emmetsburg. 5 to 8 inches of snow in extreme northwest, with drifts of 4 to 6 feet. Strong winds and accumulation of ice caused many telephone power lines to break. Many schools closed.
Minnesota, extreme southwestern counties.	18–20					Glaze, sleet, snow, and wind.	Many poles and wires down, disrupting communication and electric services. Traffic seriously delayed by snow drifts. Some loss to livestock in transit. Large branches of trees broken off. Ice began to form about 1 a. m. of 19th and remained on wires in some localities until 28th. Thickness of ice on wires varies from 1/16 to 1½ inches in diameter; heaviest ice formation in vicinity of Windom. Most damage to overhead wires and trees by combined weight of ice and moist snow. Unusually heavy snows fell in extreme southwestern counties. A C&NW train reported snowbound about 12 hours near Adrian. More than 4,200 wire breaks occurred and more than 1,050 poles were down. Loss to overhead wire systems estimated at $100,000.
Jefferson Parish, La	19	12:30 a. m.			10,000	Wind	Signs wrecked, damaging 2 buildings.
Pensacola, Fla	19	7:14—7:17 a. m.			500,000	Thundersquall	Coal tipple at Frisco Railroad wharf wrecked, when it rolled to end of track and upset. Extreme wind of 22 m. p. h. at Weather Bureau and gust of 44 m. p. h. at Naval Air Station. 1 person injured.
Wisconsin, northern portion	19–20	Noon of 19th—10 a. m., 20th.				Wind and snow	A northeast gale forced a 11,900 ton steamer aground in Superior harbor, damaging it considerably with several holes in ship's side. Another vessel also grounded. Damage to harbor at Bayfield amounted to $1,000.
Talbot County, Ga	19	1 p. m.		0		Tornado	Reports incomplete. Red Cross indicates that 2 persons injured, 2 houses and a smaller building destroyed, and 5 buildings damaged.
Atlanta (near), Ga	19	do	200	0	10,000	do	Struck Forest Park, a small community 1½ miles southeast of Atlanta city limits. Very small area affected. Storm lifting soon after it struck. 2 tenant houses destroyed, 1 was carried 150 feet. Dairy barn unroofed and made unfit for service. Garage and several small barns destroyed. Trees uprooted or blown down. About one-fourth of damage was to crops.
Plains (near), Sumter County, Ga.	19	do	100–200	0	10,000	do	Struck about 1½ miles north of Plains Community and moved northeastward, 2 miles or more on ground. 1 house destroyed, with household goods blown away. 3 widely separated tenant houses destroyed. 3 barns destroyed, including loss of 2 cows and 2 hogs and a large amount of peanuts. Automobile rolled over and wrecked. Many trees uprooted. 4 injuries. About one-tenth of damage was to crops.

[1] Miles instead of yards.

SEVERE LOCAL STORMS FOR NOVEMBER 1948—Continued

[The table hereunder contains such data as were received concerning severe local storms that occurred during the month. A revised list will appear in the United States Meteorological Yearbook]

Place	Date	Time	Width of path, yards	Loss of life	Value of property destroyed	Character of storm	Remarks
St. Louis City and St. Louis County, Mo.	19	1-4 p. m.				Wind	Straight-line winds reaching 50 m. p. h. in gusts caused minor damage to signs, roofs, and a few farm fences.
Green Bay, Wis.	19	3 p. m.			2,500	Electrical	Small home struck by lightning, partially burned.
Fayette County, Ohio	19	8 p. m.	100			Winds	Damage about 4 miles north of Jeffersonville. Windows on one side of farm home blown in; barn on another farm destroyed and small buildings and fences damaged; also corn fodder scattered over wide area.
Duluth-Superior, Minn.	19	P. m.				Snow and wind	S. S. *Robert Hobson*, Great Lakes ore carrier, grounded in Duluth-Superior harbor. S. S. *Wayne*, an excursion vessel, blown about half mile from moorings at Duluth dock. Navigation on Lake Superior impeded and many vessels held in port.
Ridgeway, S. C.	19				5,000	Wind	Man seriously injured when home destroyed. 3 nearby barns and several smaller buildings burned down.
Gesimar, La.	27				25,000	do	Church demolished; other buildings damaged.
Barry County, Mo.	27-28	Night of 27th and forenoon of 28th.				do	High winds, accompanying a 2½-inch snowstorm, disrupted light and power service at Cassville and vicinity for about 6 hours.
Fort Davis, Macon County, Ala.	28	Late forenoon.			5,000	Thundersqualls	6 cabins blown down, injuring 4 persons.
Waimea (vicinity of), Hawaii, T. H.	28-30					Winds	Crops damaged; loss to lettuce growers estimated over $20,000.

SOLAR RADIATION DATA FOR NOVEMBER 1948

[Solar Radiation Investigation Section, I. F. HAND, in Charge]

Explanation of Tables 1 and 2 and references to descriptions of instruments, stations, and methods of observation, and to summaries of data, are given in the MONTHLY WEATHER REVIEW, vol. 72, No. 1, January 1944, p. 43. A list of pyrheliometric stations is given on page 45 of that issue. An explanation of the formula used in computing the air mass values for each station listed in Table 1 appears in vol. 75, No. 3, March 1947, p. 47.

Beginning with this issue, values of total solar and sky radiation received on a horizontal surface at Inyokern, California, will appear regularly in Table 2. Mr. Edward V. Ashburn of the Astrophysical Section, U. S. Naval Ordnance Test Station at Inyokern has furnished the following data concerning the station:

> The solar radiation station on the Naval Ordnance Test Station, Inyokern, China Lake, California, is at Longitude 117°40′ E., Latitude 35°39′ N. The pyrheliometer is mounted on the south elevator tower of Michelson Laboratory. There are no adjacent obstructions but the distant mountains average about 1° above the horizon. Michelson Laboratory is in the Indian Wells Valley about fifteen miles east of the Sierra Nevada range. The adjacent residential area occasionally produces noticeable smoke and haze during the winter months but usually the air is remarkably clear and dry. An Eppley 50-junction pyrheliometer Serial No. 1620 is used with a Brown continuous recording potentiometer.

TABLE 1.—*Solar radiation intensities during November 1948*

[Gram calories per minute per square centimeter of normal surface]

Date	Sun's zenith distance									Vapor pressure	
	A. M.				0.0°	P. M.					
	78.7°	75.7°	70.7°	60.0°		60.0°	70.7°	75.7°	78.7°	7:30 a. m.[1]	1:30 p. m.[1]
MADISON, WIS.											
	Air mass										
	4.81	3.84	2.88	1.92	1.92	2.88	3.84	4.81			
November	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*mb.*	*mb.*
1	0.52	0.64	0.75	0.95	1.29	------	------	------	------	7.8	12.7
15	.76	.92	1.01	------	1.33	------	------	------	------	5.3	6.1
17	.98	1.08	1.18	------	1.43	------	------	------	------	4.8	5.3
29	.75	.91	1.08	------	------	------	------	------	------	3.0	3.8
Means	.75	.89	1.00	.95	1.35	------	------	------	------	------	------
Departures	−.09	−.09	−.14	−.35	−.16	------	------	------	------	------	------
BLUE HILL, MASS.											
	Air mass										
	4.86	3.89	2.92	1.94	*0.97	1.94	2.92	3.89	4.86		
November	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*mb.*	*mb.*
2	0.84	0.97	1.10	1.29	------	1.35	1.22	1.10	1.01	5.3	6.4
8	.85	------	------	------	------	1.25	1.12	------	------	6.6	5.8
11	1.00	1.09	1.21	1.40	------	1.37	1.18	1.07	.94	6.9	4.6
14	.99	1.09	1.18	------	------	------	1.22	1.13	1.03	3.9	3.8
16	.74	.84	.96	------	------	------	------	------	------	5.2	5.4
18	.94	1.07	1.18	------	------	1.27	1.05	.92	.81	6.1	5.2
19	.83	.92	1.07	------	------	------	------	------	------	5.1	6.5
21	.69	.82	.92	------	------	------	------	------	------	7.3	6.4
26	------	------	.93	------	------	------	------	.93	.83	5.9	6.9
28	.97	1.05	------	------	------	------	------	------	------	5.0	5.2
30	.99	1.09	------	------	------	------	1.21	1.07	.95	3.8	5.7
Means	.88	.99	1.07	(1.34)	------	1.31	1.17	1.04	.93	------	------
Departures	−.03	−.02	−.04	+.06	------	+.05	+.06	+.06	+.07	------	------

See footnotes at end of table

TABLE 1.—*Solar radiation intensities during November 1948*—Con.

[Gram calories per minute per square centimeter of normal surface]

Date	Sun's zenith distance									Vapor pressure	
	A. M.				0.0°	P. M.					
	78.7°	75.7°	70.7°	60.0°		60.0°	70.7°	75.7°	78.7°	7:30 a. m.[1]	1:30 p. m.[1]
BOSTON, MASS.											
	Air mass										
	4.96	3.96	2.97	1.98	*0.99	1.98	2.97	3.96	4.96		
November	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*mb.*	*mb.*
1	------	0.60	0.75	------	------	------	------	------	------	9.1	8.1
2	------	.65	.93	------	------	------	------	------	------	5.8	6.4
16	------	------	.78	------	------	------	------	------	------	5.8	5.1
18	------	.85	1.00	------	------	------	------	------	------	6.8	6.1
19	------	------	.41	------	------	------	------	------	------	6.8	8.1
30	0.68	.59	------	------	------	------	------	------	------	4.1	5.4
Means	(.68)	.67	.77	------	------	------	------	------	------	------	------
Departures	−.04	−.13	−.14	------	------	------	------	------	------	------	------
CLIMAX, COLORADO											
	Air mass										
	3.24	2.59	1.94	1.29	*0.65	1.29	1.94	2.59	3.24		
November	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*mb.*	*mb.*
1	------	------	1.37	1.46	------	1.50	1.39	1.30	1.22	------	------
5	------	------	------	1.55	------	1.56	1.43	1.31	------	------	------
12	------	------	------	1.46	------	1.48	1.34	1.24	1.12	------	------
13	------	------	------	1.56	------	1.48	1.41	1.30	1.22	------	------
14	------	------	------	1.54	------	1.54	1.42	1.30	1.22	------	------
15	1.30	1.39	1.46	1.58	------	1.57	1.44	------	1.21	------	------
21	------	1.16	1.28	1.42	------	1.16	------	------	------	------	------
28	------	------	------	------	------	------	1.43	1.32	1.26	------	------
29	------	------	------	------	------	------	1.46	1.37	1.29	------	------
30	1.44	1.49	1.55	------	------	------	1.36	1.16	1.00	------	------
Means	(1.37)	1.35	1.42	1.51	------	1.47	1.41	1.29	1.19	------	------
Departures	+.14	+.02	−.01	−.02	------	−.03	+.02	+.01	+.02	------	------
LINCOLN, NEBR.											
	Air mass										
	4.77	3.81	2.86	1.91	*0.95	1.91	2.86	3.81	4.77		
November	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*mb.*	*mb.*
6	0.94	1.07	1.18	1.34	------	1.34	1.16	1.05	0.94	5.3	5.8
13	------	.86	1.10	1.27	------	1.27	1.11	.96	.81	3.7	4.8
15	------	------	------	------	------	------	1.03	.90	.82	6.9	7.8
16	------	------	------	------	------	1.31	1.16	1.03	.92	6.6	6.6
23	.81	.94	1.09	------	------	------	------	------	------	4.2	5.1
29	------	1.01	1.18	------	------	------	1.16	1.05	------	4.2	4.8
Means	(0.88)	0.97	1.14	(1.30)	------	1.31	1.12	1.00	0.87	------	------
Departures	−.01	−.04	−.02	−.06	------	−.02	−.05	−.02	−.04	------	------
TABLE MOUNTAIN, CALIF.											
	Air mass										
	3.76	3.01	2.26	1.51	*0.75	1.51	2.26	3.01	3.76		
November	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*mb.*	*mb.*
1	1.14	1.22	1.33	1.45	------	------	------	------	------	------	------
2	------	------	------	1.46	------	------	------	------	------	------	------
3	------	------	------	1.49	------	------	------	------	------	------	------
5	------	------	------	1.49	------	------	------	------	------	------	------
9	1.22	1.30	1.40	1.52	------	------	------	------	------	------	------
13	------	------	------	1.51	------	------	------	------	------	------	------
14	1.25	1.33	1.42	1.54	------	------	------	------	------	------	------
16	------	------	------	1.49	------	------	------	------	------	------	------
23	1.15	1.24	1.35	1.47	------	------	------	------	------	------	------
25	------	------	------	1.55	------	------	------	------	------	------	------
30	------	------	------	1.57	------	------	------	------	------	------	------
Means	1.19	1.27	1.38	1.50	------	------	------	------	------	------	------
Departures	+.02	+.01	+.02	.00	------	------	------	------	------	------	------

Note.—Figures in parenthesis are interpolated.

*Extrapolated.

[1] 75th Meridian Time.

TABLE 2.—*Daily totals and weekly means of solar radiation (direct + diffuse) received on a horizontal surface*

[Gram-calories per square centimeter]

Date	Washington, D. C.	Madison, Wis.	Lincoln, Nebr.	New York, N. Y.	Fresno, Calif.	Fairbanks, Alaska	Columbia, Mo.	Boston, Mass.	Nashville, Tenn.	Twin Falls, Idaho	La Jolla, Calif.	Riverside, Calif.	Blue Hill, Mass.	Newport, R. I.	Salt Lake City, Utah	Put-in-Bay, Ohio	State College, Pa.	Davis, Calif.	Toronto, Canada	Ithaca, N. Y.	East Wareham, Mass.	Honolulu, T. H.	Pearl Harbor, T. H.	East Lansing, Mich.	Summit, Mont.	Soda Springs, Calif.	Grand Lake, Colo.	Inyokern, Calif.
1948	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*
Oct. 29	158	230	87	248	209	4	306	232	310	-----	173	102	262	270	270	274	304	319	31	35	237	394	414	202	262	(90)	133	394
Oct. 30	194	133	334	299	382	16	194	252	242	-----	302	330	295	311	240	234	258	350	159	194	266	559	482	172	164	(354)	282	251
Oct. 31	-----	218	337	246	360	71	245	245	174	-----	358	355	270	296	302	190	177	134	38	122	264	516	493	14	70	116	364	388
Nov. 1	128	243	60	186	322	12	82	268	32	-----	308	322	253	197	230	332	123	60	60	88	245	426	295	113	148	16	375	385
Nov. 2	22	48	292	185	364	16	52	302	80	-----	340	321	305	349	299	158	28	192	57	48	288	512	465	88	96	95	178	366
Nov. 3	6	42	232	48	219	57	42	190	142	-----	111	86	216	207	82	64	25	360	150	164	202	491	444	6	73	279	78	366
Nov. 4	92	80	40	55	365	12	213	41	279	-----	324	360	16	66	244	343	94	363	90	112	94	193	166	97	95	369	204	400
Means	100	142	197	181	317	27	162	218	180	-----	274	268	231	242	238	228	144	253	84	109	228	441	394	99	130	188	230	364
Departures	−138	−39	−31	−22	−6	−18	−11	+54	−35	-----	−63	−43	+21	+27	−2	+34	−34	−31	−22	−44	+20	0	+5	−40	-----	−77	-----	-----
Nov. 5	120	64	40	97	349	18	104	148	25	-----	337	350	131	101	323	148	138	-----	73	147	112	225	185	31	(83)	(330)	270	403
Nov. 6	139	86	325	190	297	35	364	100	181	-----	331	321	80	225	135	289	35	-----	71	61	168	458	420	5	141	144	164	319
Nov. 7	325	188	104	282	351	29	298	139	351	-----	309	268	119	147	341	593	281	-----	135	162	132	218	155	218	178	354	153	378
Nov. 8	269	112	96	207	335	5	173	240	310	275	321	339	252	261	284	542	269	-----	182	168	237	386	356	152	110	(351)	276	396
Nov. 9	84	30	193	114	346	71	122	210	150	260	338	339	222	215	304	129	124	-----	108	134	212	390	407	48	(107)	(337)	141	390
Nov. 10	171	120	230	57	249	11	308	98	344	80	334	313	53	80	87	197	40	-----	15	42	84	347	300	109	(147)	278	155	314
Nov. 11	306	163	78	285	333	12	316	250	332	248	316	307	266	291	119	291	290	-----	209	163	268	455	338	150	(54)	336	217	360
Means	202	109	152	176	323	26	241	169	242	-----	327	320	160	189	228	313	168	-----	113	125	173	354	309	102	117	304	197	366
Departures	−18	−49	−70	−3	+29	−9	+63	+35	+53	-----	+18	+18	−20	−7	+4	+159	+24	-----	+13	−5	+8	−43	−37	+8	-----	+37	-----	-----
Nov. 12	197	87	212	107	339	15	43	118	51	245	333	314	104	139	138	44	106	290	35	39	134	431	312	22	(78)	313	120	365
Nov. 13	179	121	297	111	317	13	336	44	298	224	326	310	26	33	286	84	119	292	78	84	35	415	408	76	(115)	312	300	367
Nov. 14	261	95	286	279	308	14	319	249	306	122	324	312	259	278	275	159	257	224	99	137	263	434	451	74	(56)	(288)	322	353
Nov. 15	147	224	264	196	327	11	320	83	287	102	253	241	145	212	103	238	68	252	68	22	180	503	342	139	56	286	298	310
Nov. 16	227	72	240	175	312	31	184	163	45	44	276	287	212	237	128	132	172	112	139	131	187	355	269	115	(73)	89	103	314
Nov. 17	250	219	193	88	199	36	314	7	324	208	291	254	28	27	-----	284	255	307	76	125	31	419	360	180	(70)	327	91	356
Nov. 18	256	71	22	221	303	38	119	181	214	239	277	292	236	254	275	244	244	273	138	150	226	514	449	159	(140)	290	257	340
Means	217	127	216	168	301	22	234	121	218	169	297	287	144	168	201	170	175	250	90	98	151	439	370	109	84	272	213	344
Departures	+18	−26	+8	+14	+55	−5	+22	−14	+9	+7	+12	+11	−19	−15	+8	+16	+4	+45	+2	−12	−25	+13	+11	−6	-----	−3	-----	-----
Nov. 19	45	14	50	57	238	25	36	114	187	81	308	288	205	226	78	66	14	118	13	10	215	437	426	2	(51)	154	269	307
Nov. 20	263	34	119	187	123	10	50	6	301	146	255	274	12	44	51	57	62	292	71	44	35	523	360	27	(46)	(295)	180	338
Nov. 21	257	24	200	232	299	33	155	146	285	121	315	312	175	221	211	203	104	295	45	24	178	482	411	36	(95)	(304)	297	344
Nov. 22	24	43	70	49	302	23	40	16	60	62	335	298	46	55	144	45	17	274	47	17	58	520	358	19	(53)	276	252	320
Nov. 23	187	138	177	169	298	17	309	1	165	164	313	265	7	24	228	45	80	272	102	23	24	482	397	8	(70)	279	107	327
Nov. 24	79	130	164	190	284	5	119	1	146	194	281	256	14	19	84	104	223	196	37	23	78	426	388	57	(48)	216	94	312
Nov. 25	211	88	156	208	229	10	256	2	272	108	281	260	12	37	206	190	205	227	98	83	32	447	375	50	(84)	238	308	328
Means	153	67	134	156	253	18	138	41	202	125	298	279	67	90	143	101	101	239	59	32	88	474	388	28	64	252	215	325
Departures	−31	−62	−60	+15	+19	+2	−16	−57	+25	−30	+11	+3	−79	−66	−27	−17	−31	+14	−15	−79	−51	+32	+20	−60	-----	−6	-----	-----
Nov. 26	208	193	246	111	263	14	184	75	21	167	210	258	188	227	164	37	205	285	48	120	198	519	432	94	(80)	305	263	316
Nov. 27	253	180	78	154	285	7	195	42	80	202	310	286	49	65	138	173	235	274	112	110	58	470	308	49	(107)	(274)	227	335
Nov. 28	16	117	304	75	293	8	233	124	19	202	286	269	144	155	240	54	84	262	57	41	153	467	410	37	(38)	295	317	326
Nov. 29	41	242	259	47	276	4	309	1	33	176	285	275	9	20	206	98	94	278	57	68	23	325	380	145	(73)	291	231	329
Nov. 30	168	206	199	170	234	11	268	144	266	53	279	266	211	222	162	222	154	234	71	75	168	290	248	32	41	200	286	299
Dec. 1	244	208	227	133	256	T	-----	48	254	210	277	262	91	153	226	147	202	264	125	46	135	230	185	116	62	(264)	121	316
Dec. 2	165	185	262	122	252	10	-----	152	139	59	281	260	213	213	205	173	139	194	142	117	204	361	314	132	(38)	(172)	172	317
Means	156	190	225	116	266	8	238	84	116	153	275	268	129	151	192	129	159	256	87	82	134	380	325	86	63	257	231	320
Departures	−11	+62	+45	−13	+61	−3	+60	−12	−41	+9	+15	+14	−20	−6	+64	+18	+29	+70	+13	−7	−7	−24	−21	0	-----	+2	-----	-----

ACCUMULATED DEPARTURES ON DECEMBER 2, 1948

	− 7280	+ 7294	+ 6279	− 7007	+ 13258	}	-----	-----	{ − 4501 }	-----	-----	-----	{ − 6251 }	-----	{ − 6251	− 364	− 511 }	-----	{ − 2401	− 2744	+ 1708	− 25473	− 2100 }	-----	-----	{ − 1288 }	-----	-----	-----	-----

TABLE 3.—*Daily totals and weekly means of solar and sky radiation plus the radiation reflected from the ground, as received on a vertical surface facing south at Blue Hill, Mass., during November 1948*

Date	29	30	31	1	2	3	4	Mean	5	6	7	8	9	10	11	Mean	12	13	14	15
Gm cal/cm²	382	479	426	350	505	302	13	351	143	68	183	445	336	40	511	246	294	23	514	194

Date	16	17	18	Mean	19	20	21	22	23	24	25	Mean	26	27	28	29	30	1	2	Mean
Gm cal/cm²	398	22	477	246	396	7	332	21	4	6	6	110	381	90	251	6	489	91	491	257

Chart I. Departure (°F.) of the Mean Temperature from the Normal and Wind Roses for Selected Stations, November 1942

Chart I. Departure (°F.) of the Mean Temperature from the Normal, and Wind Roses for Selected Stations, November 1948

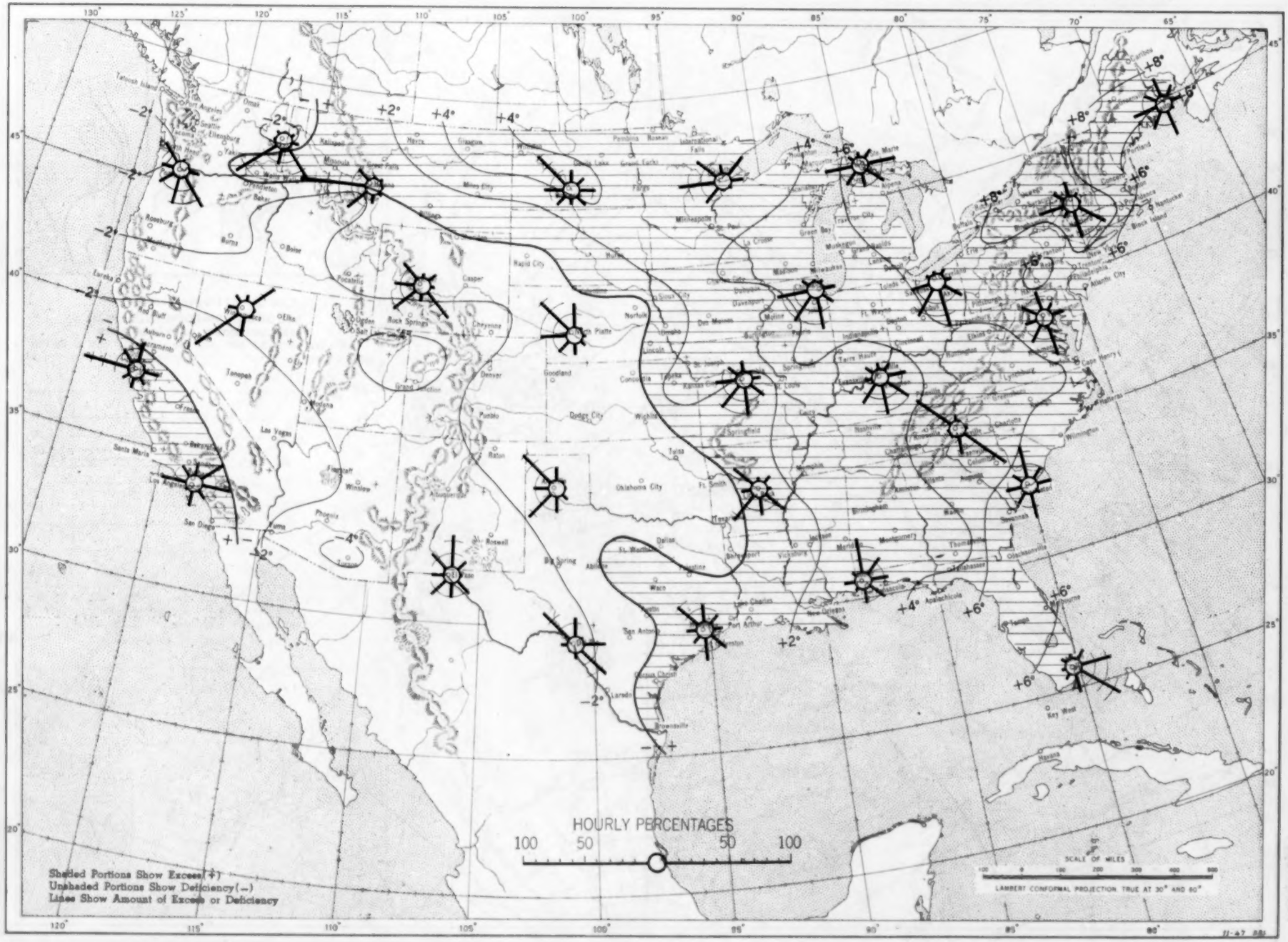
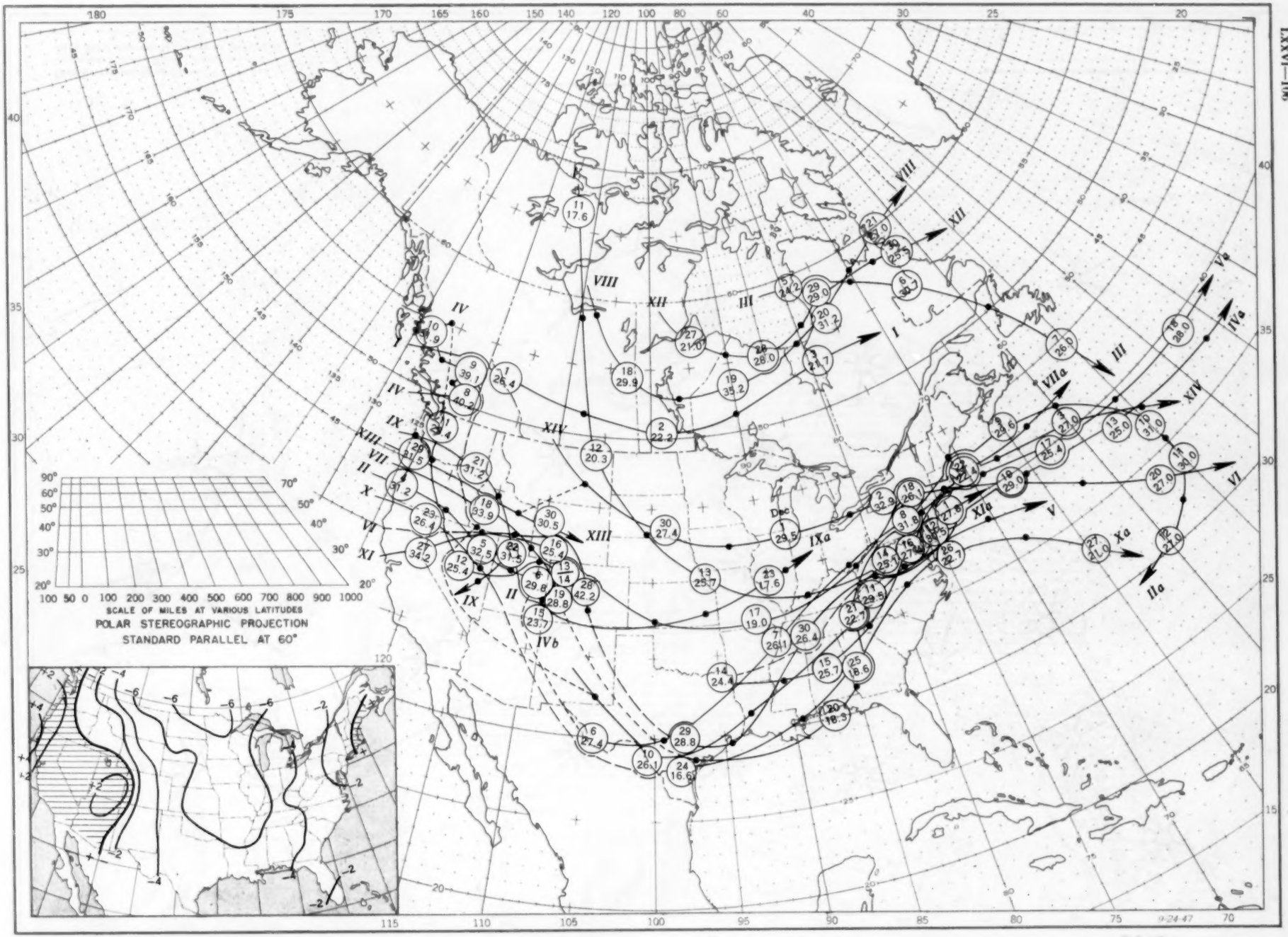

HOURLY PERCENTAGES
100 50 50 100
Shaded Portions Show Excess (+)
Unshaded Portions Show Deficiency (−)
Lines Show Amount of Excess or Deficiency
SCALE OF MILES
LAMBERT CONFORMAL PROJECTION TRUE AT 30° AND 60°

Chart II. Tracks of Centers of Anticyclones, November 1948. (Inset) Departure of Monthly Mean Pressure from Normal

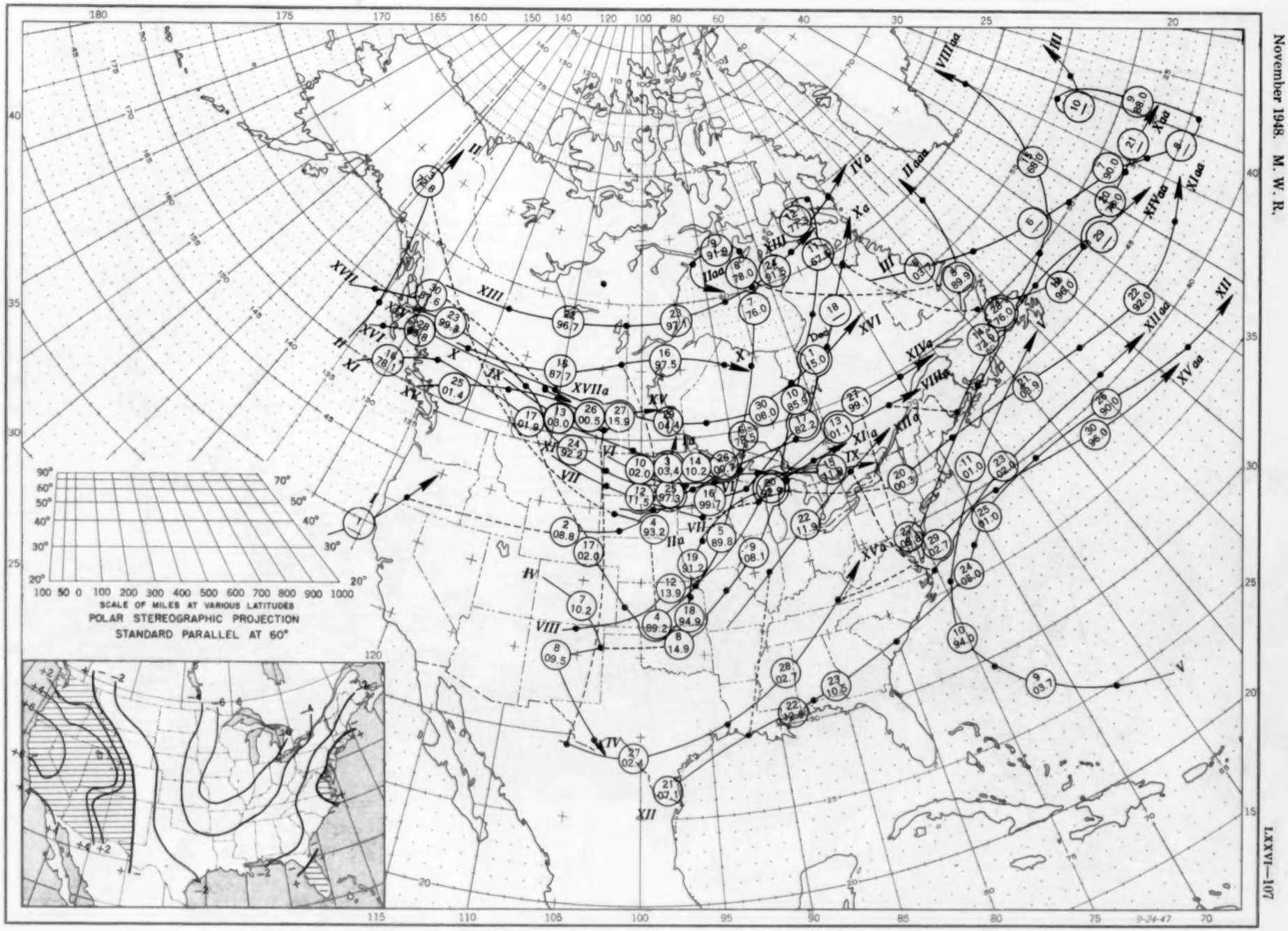


Circle indicates position of anticyclone at 7:30 a. m. (75th meridian time), with barometric reading. Dot indicates position of anticyclone at 7:30 p. m. (75th meridian time)

Chart III. Tracks of Centers of Cyclones, November 1948. (Inset) Change in Mean Pressure from Preceding Month

Circle indicates position of anticyclone at 7:30 a. m. (75th meridian time)

Chart III. Tracks of Centers of Cyclones, November 1948. (Inset) Change in Mean Pressure from Preceding Month



Circle indicates position of cyclone at 7:30 a. m. (75th meridian time), with barometric reading. Dot indicates position of cyclone at 7:30 p. m. (75th meridian time)

Chart IV. Percentage of Clear Sky Between Sunrise and Sunset, November 1948

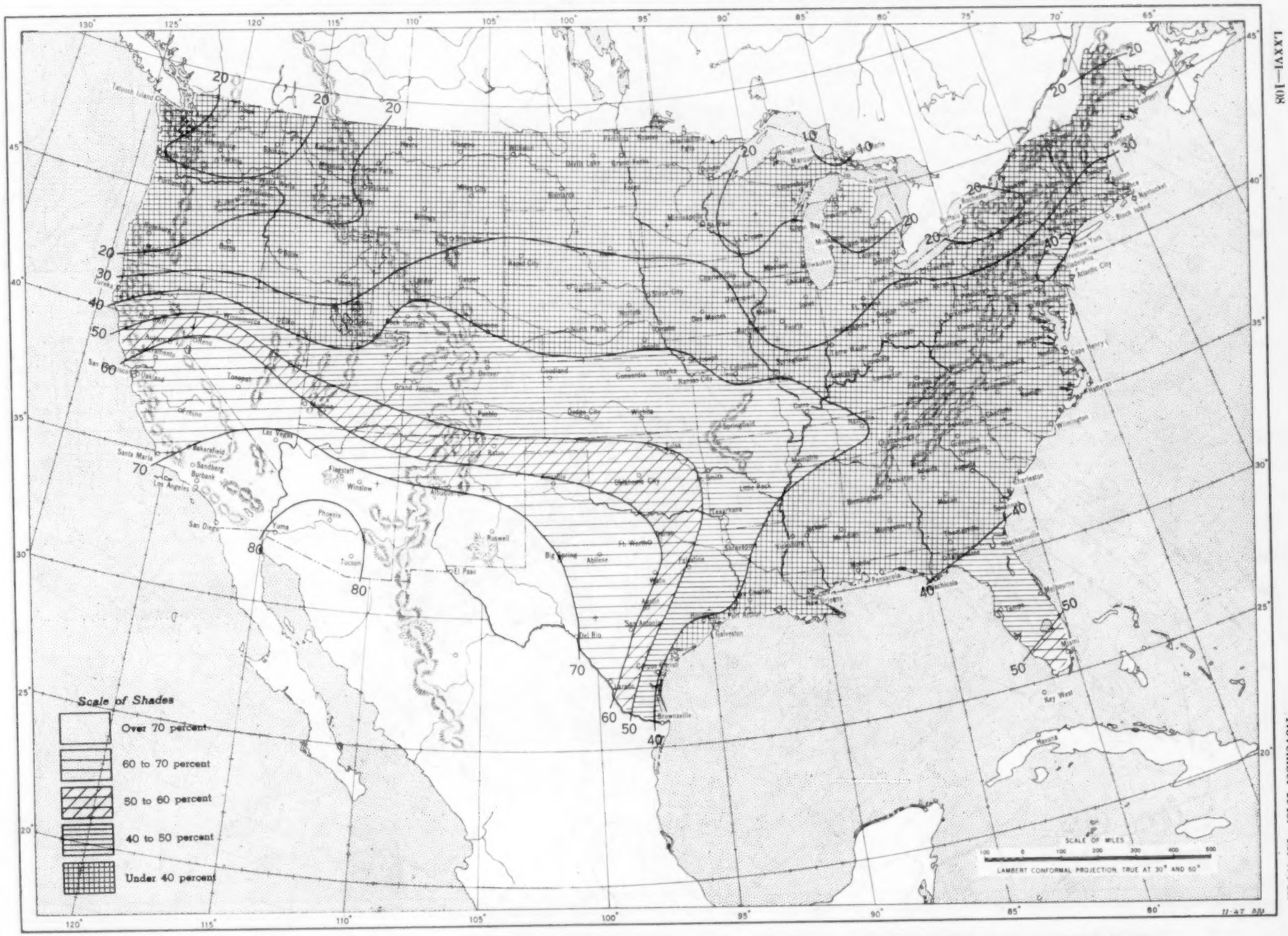

Scale of Shades
Over 70 percent
60 to 70 percent
50 to 60 percent
40 to 50 percent
Under 40 percent
SCALE OF MILES
LAMBERT CONFORMAL PROJECTION, TRUE AT 30° AND 60°

Chart V. Total Precipitation, Inches, November 1948. (Inset) Departure of Precipitation from Normal

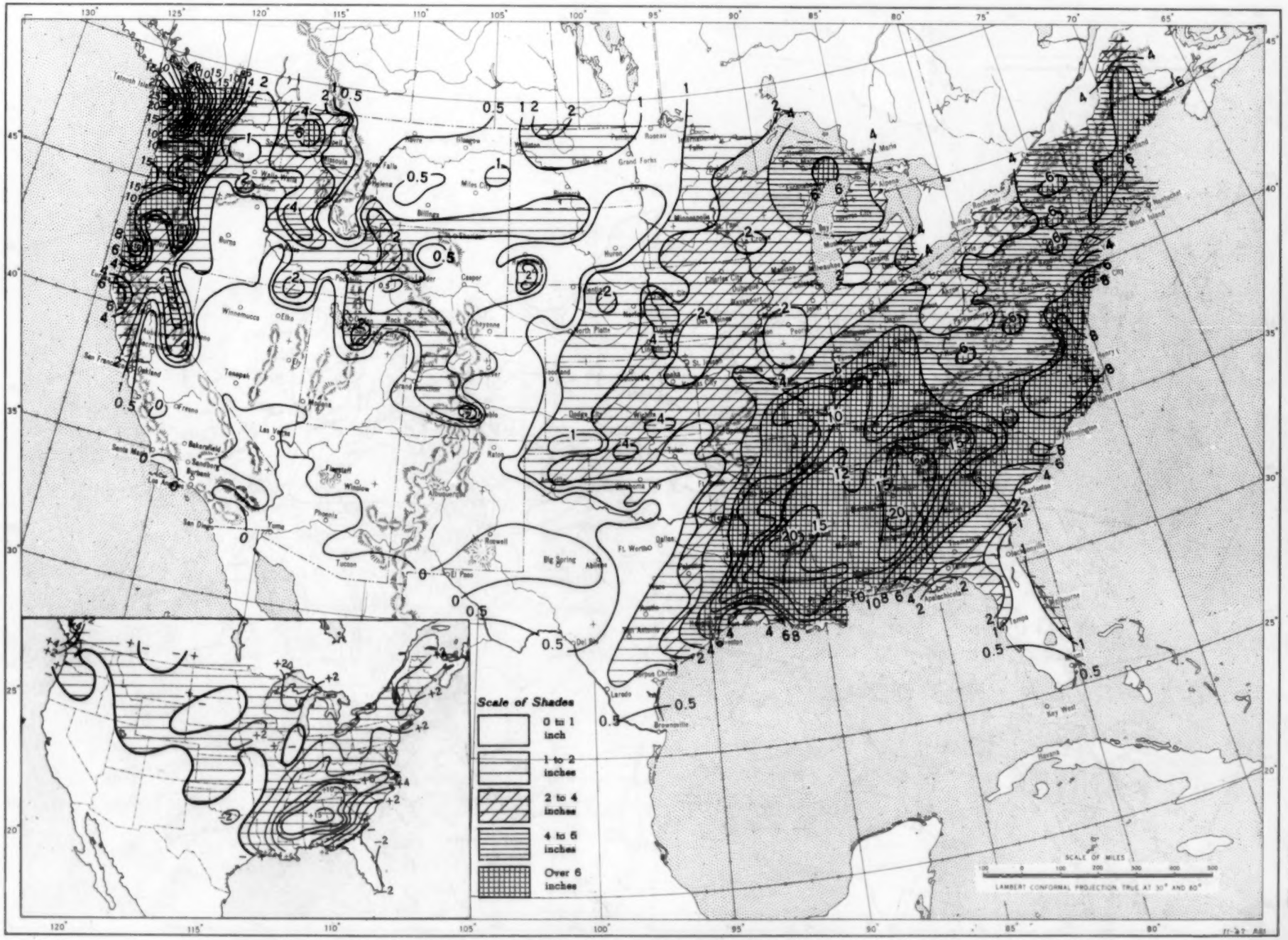

Scale of Shades
0 to 1 inch
1 to 2 inches
2 to 4 inches
4 to 6 inches
Over 6 inches
SCALE OF MILES
LAMBERT CONFORMAL PROJECTION, TRUE AT 30° AND 60°

Chart VI. Isobars (mb.) at Sea Level and Isotherms (°F.) at Surface; Prevailing Winds, November 1948

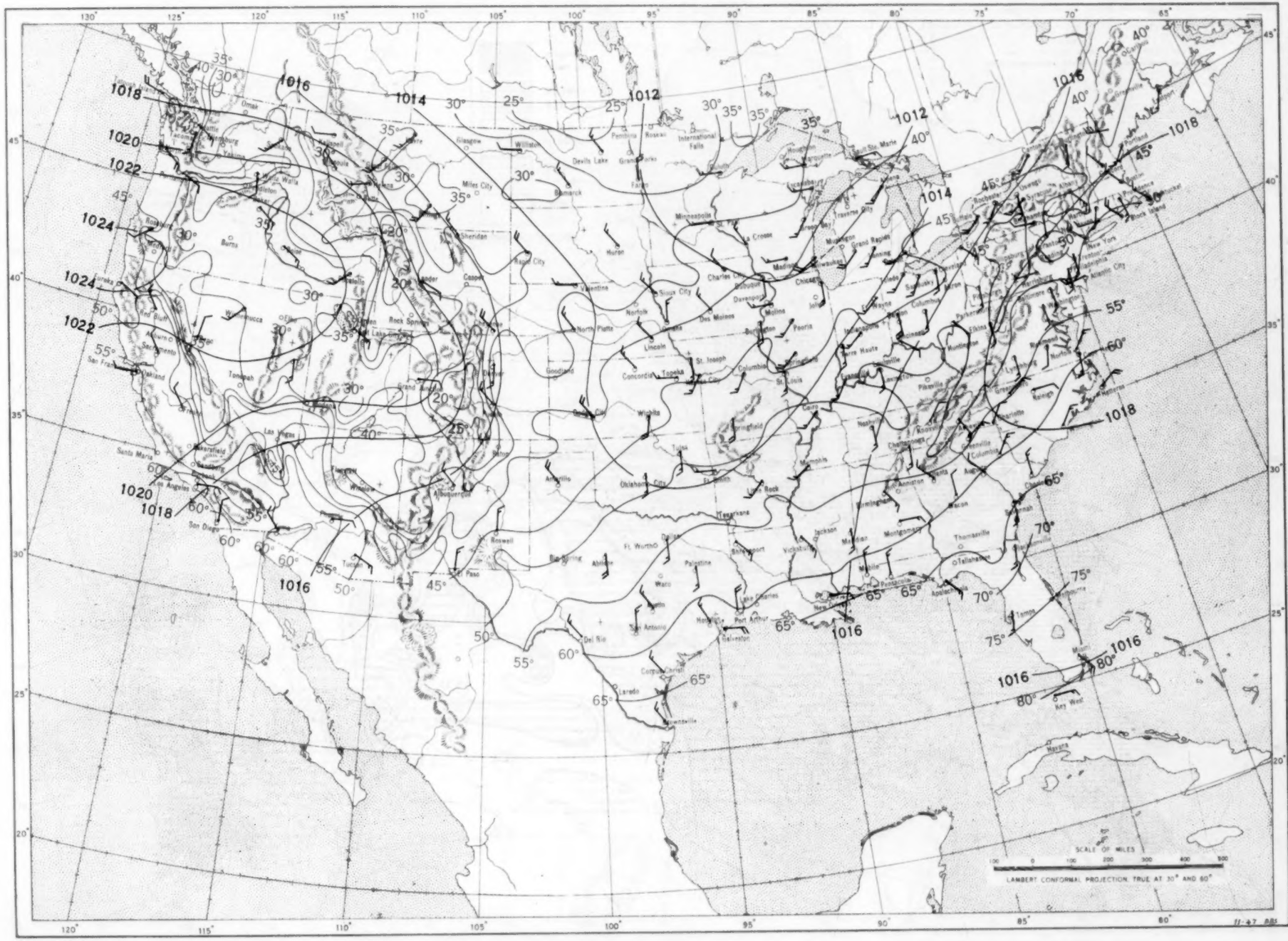
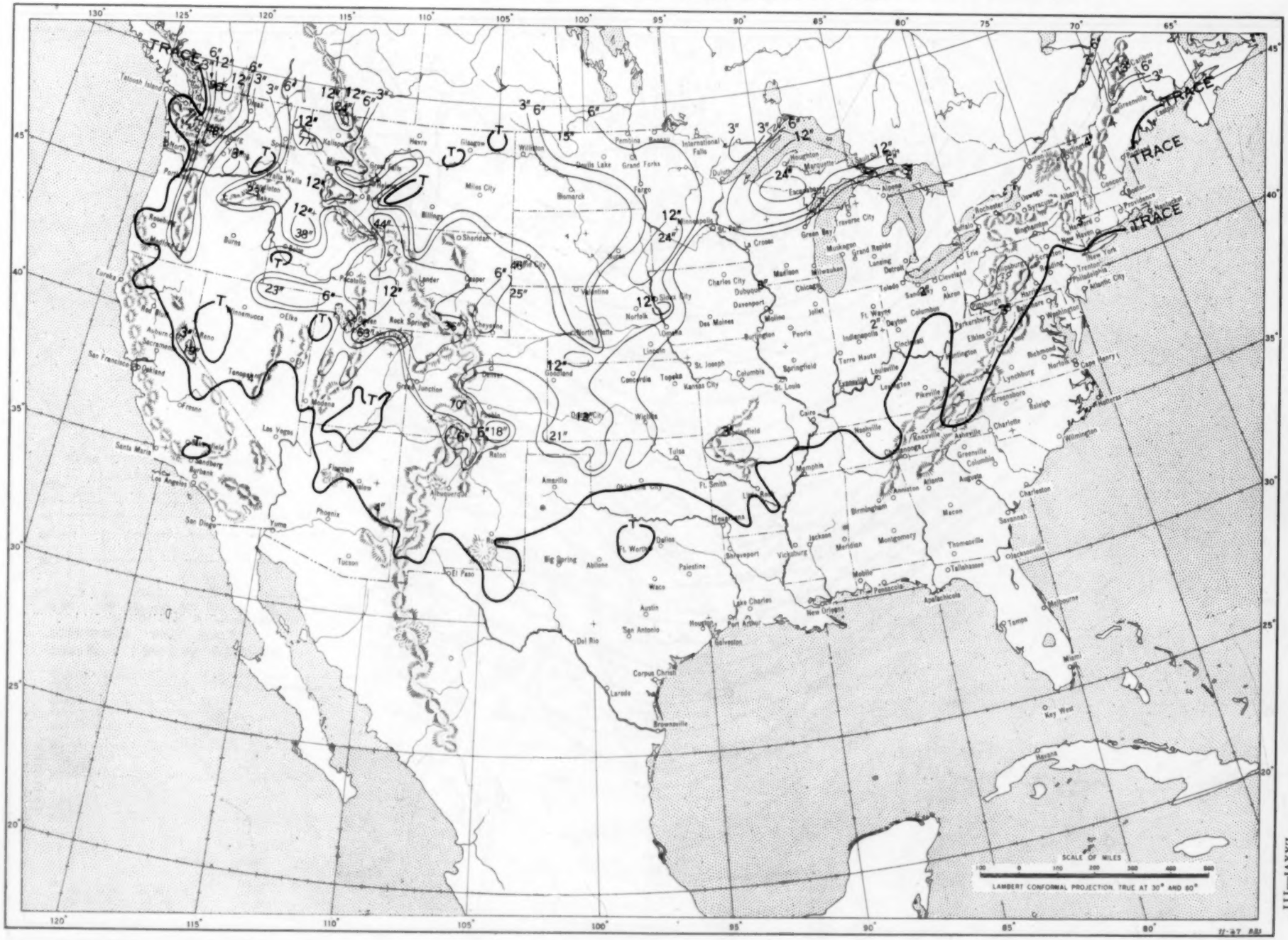


Chart VII Total Snowfall, Inches, November 1948.

Chart VII Total Snowfall, Inches, November 1948.



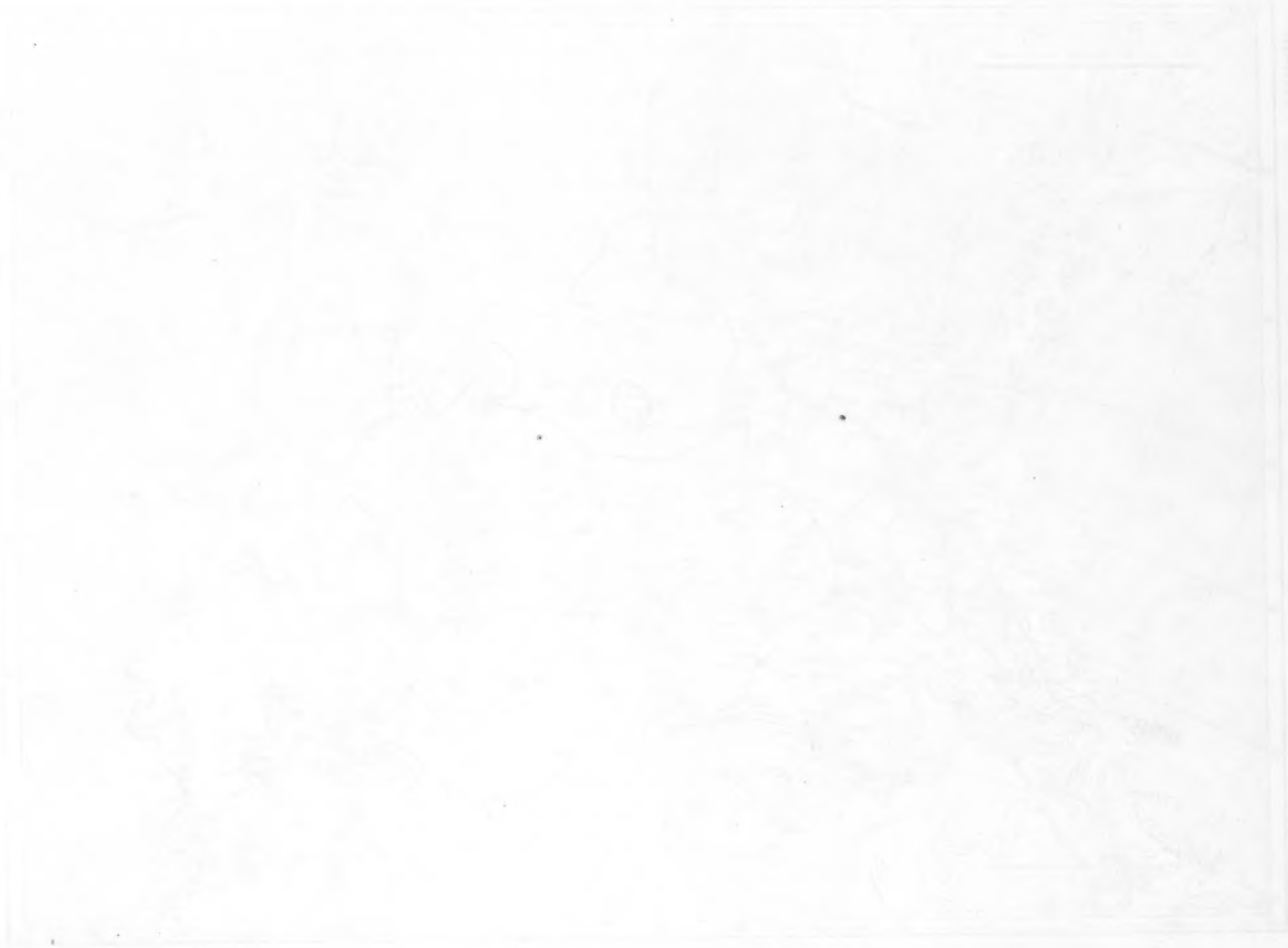
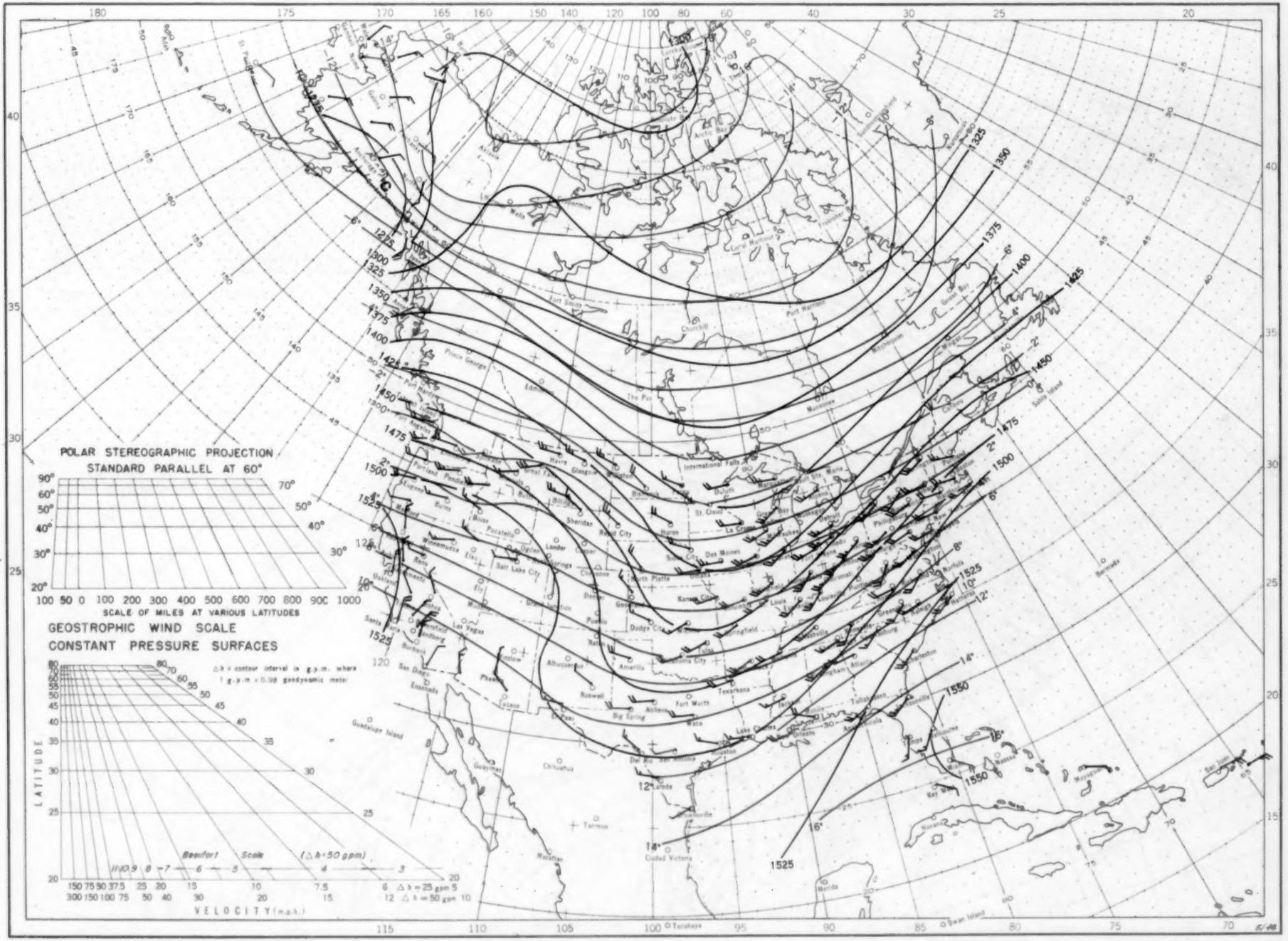


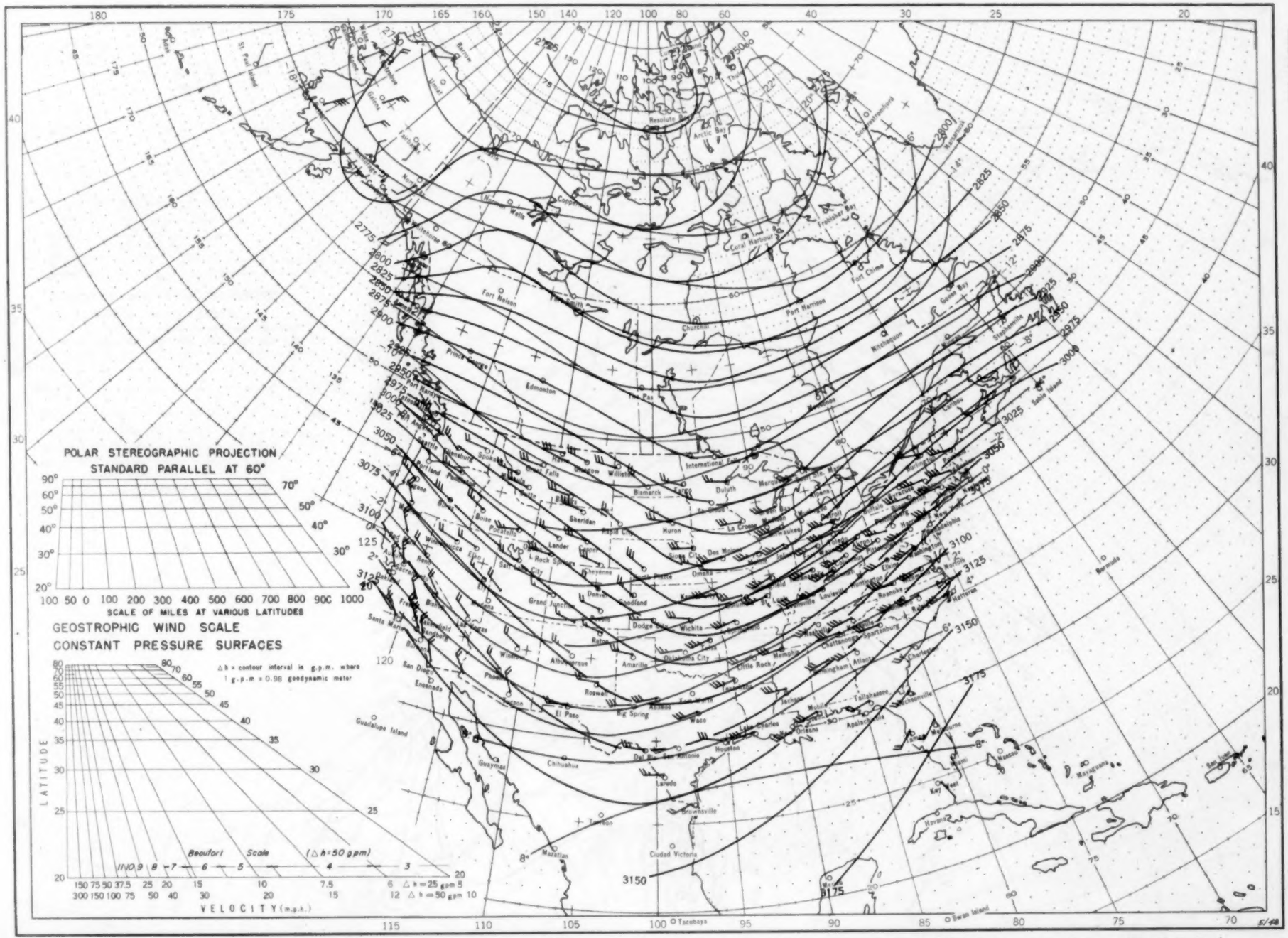
Chart VIII, November 1948. Contour Lines of Dynamic Height (Geopotential) in Units of 0.98 Dynamic Meters and Isotherms in Degrees Centigrade for the 850-millibar Pressure Surface, and Resultant Winds at 1,500 Meters (m. s. l.)

Chart VIII, November 1948. Contour Lines of Dynamic Height (Geopotential) in Units of 0.98 Dynamic Meters and Isotherms in Degrees Centigrade for the 850-millibar Pressure Surface, and Resultant Winds at 1,500 Meters (m. s. l.)



Contour lines and isotherms based on radiosonde observations at 0300 G. C. T. Winds indicated by black arrows based on pilot balloon observations at 2200 G. C. T.; those indicated by red arrows based on rawins taken at 0300 G. C. T.

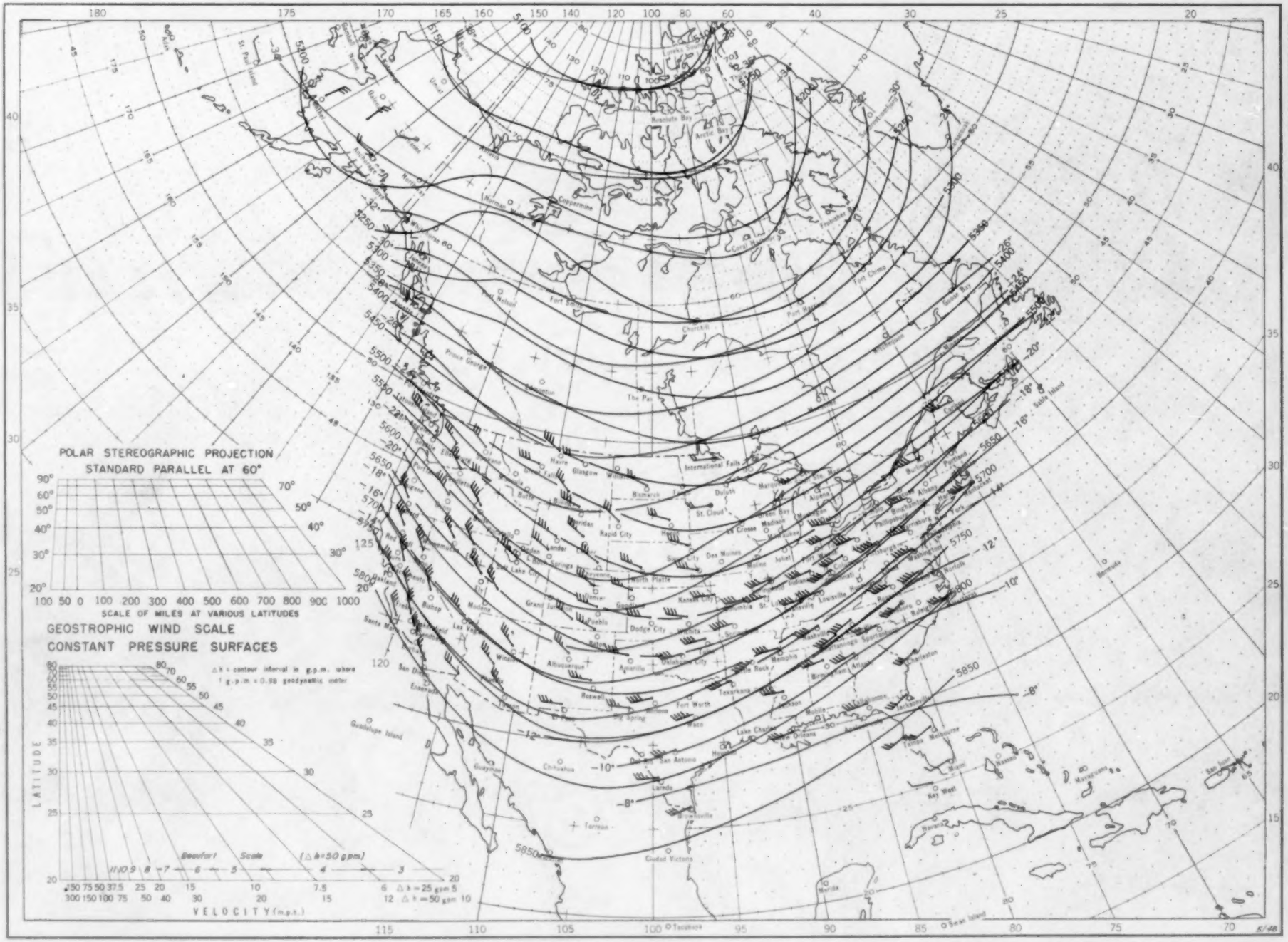
Chart IX, November 1948. Contour Lines of Dynamic Height (Geopotential) in Units of 0.98 Dynamic Meters and Isotherms in Degrees Centigrade for the 700-millibar Pressure Surface, and Resultant Winds at 3,000 Meters (m. s. l.)



Contour lines and isotherms based on radiosonde observations at 0300 G. C. T. Winds indicated by black arrows based on pilot balloon observations at 2200 G. C. T.; those indicated by red arrows based on rawins taken at 0300 G. C. T.

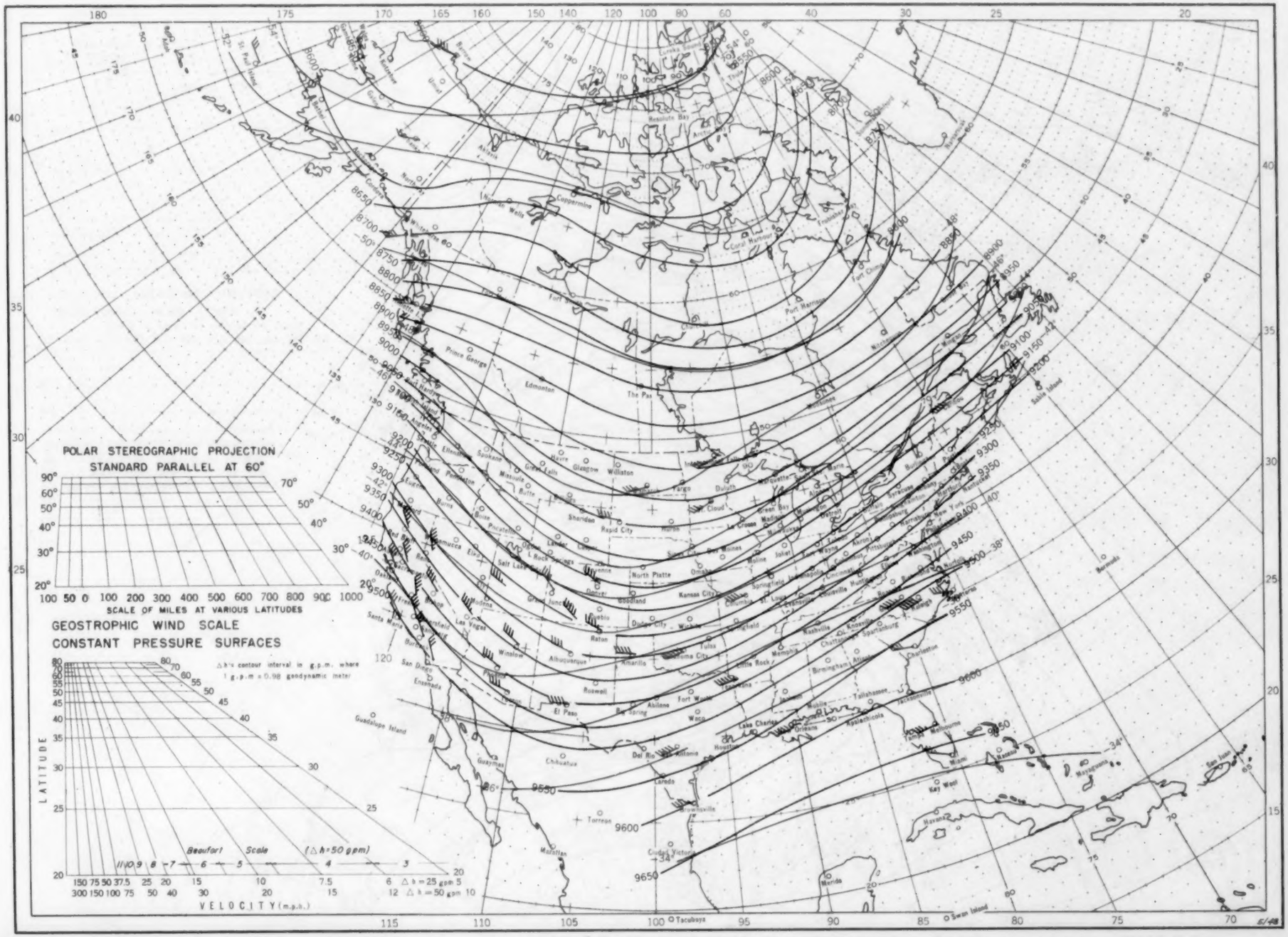
Chart X, November 1948. Contour Lines of Dynamic Height (Geopotential) in Units of 0.98 Dynamic Meters and Isotherms in Degrees Centigrade for the 500-millibar Pressure Surface, and Resultant Winds at 5,000 Meters (m. s. l.)

Chart X, November 1948. Contour Lines of Dynamic Height (Geopotential) in Units of 0.98 Dynamic Meters and Isotherms in Degrees Centigrade for the 500-millibar Pressure Surface, and Resultant Winds at 5,000 Meters (m. s. l.)



Contour lines and isotherms based on radiosonde observations at 0300 G. C. T. Winds indicated by black arrows based on pilot balloon observations at 2200 G. C. T.; those indicated by red arrows based on rawins taken at 0300 G. C. T.

Chart XI, November 1948. Contour Lines of Dynamic Height (Geopotential) in Units of 0.98 Dynamic Meters and Isotherms in Degrees Centigrade for the 300-millibar Pressure Surface, and Resultant Winds at 10,000 Meters (m. s. l.)



Contour lines and isotherms based on radiosonde observations at 0300 G. C. T. Winds indicated by black arrows based on pilot balloon observations at 2200 G. C. T.; those indicated by red arrows based on rawins taken at 0300 G. C. T.